Proceedings of the 27th Annual Meeting of the Plant Pathology Society of Alberta

November 7th to 9th, 2006
University of Alberta Conference Centre
Edmonton, Alberta

Sponsorship Provided By:
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## Schedule of Events – 27th Annual Meeting

**November 7-9, 2006**

**Lister Conference Centre, University of Alberta**

**Edmonton, Alberta**

116th Street and 87th Avenue, Edmonton

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<th>Date &amp; Time</th>
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<td><strong>Tuesday, Nov. 7th</strong></td>
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<tr>
<td>5:00pm – 8:00pm</td>
<td>Registration</td>
<td>Glacier Room/Foyer</td>
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<td>6:00pm – 9:00pm</td>
<td>Wine and cheese reception</td>
<td>Glacier Room/Foyer</td>
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<td><strong>Wednesday, Nov. 8th</strong></td>
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<tr>
<td>8:00am – 10:00am</td>
<td>Registration</td>
<td>Foyer</td>
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<td>8:00am – 8:30am</td>
<td>Poster set-up</td>
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<td>8:30am – 8:45am</td>
<td>Welcome and opening remarks</td>
<td>Prairie Room</td>
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<tr>
<td>8:45am – 10:00am</td>
<td>Paper session I</td>
<td>Prairie Room</td>
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<td>10:00am – 10:30am</td>
<td>Refreshment break</td>
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<tr>
<td>10:30am – 12:00pm</td>
<td>Paper session II</td>
<td>Prairie Room</td>
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<td>12:00pm – 1:30pm</td>
<td>Lunch</td>
<td>Glacier Room</td>
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<td>1:30pm – 3:00pm</td>
<td>Poster session</td>
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<td>Refreshment break</td>
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<tr>
<td>3:30pm – 5:00pm</td>
<td>Paper session III</td>
<td>Prairie Room</td>
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<tr>
<td>7:00pm – 9:30pm</td>
<td>Banquet</td>
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<td><strong>Thursday, Nov. 9th</strong></td>
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<td>8:30am – 10:00am</td>
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<td>10:00am – 10:30am</td>
<td>Refreshment break</td>
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<td>10:30am – 11:30am</td>
<td>Paper session IV</td>
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<td>11:30 am</td>
<td>Posters come down</td>
<td>Foyer</td>
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Tuesday November 7th, 2006

5:00 – 8:00 PM  **Registration**, Glacier Room/Foyer
6:00 – 9:00 PM  **Wine & Cheese Reception**, Glacier Room/Foyer

*Sponsored by University of Alberta*

Wednesday November 8th, 2006

8:00 – 10:00 AM  **Registration**, Foyer

**Paper Session I**
**Prairie Room – Chair: Stephen Strelkov**

08:30 AM  **Welcome and opening remarks:**
  
  Dr. Stephen Strelkov, President, PPSA
  
  Dr. Bruce Gossen, President CPS/SCP

08:45 AM  **B.D. Gossen.** Issues and Initiatives in the Canadian Phytopathological Society

09:00 AM  **S. Amaike, J. Ozga, U. Basu, and S.E. Strelkov.** In planta quantification of *ToxB* gene expression by *Pyrenophora tritici-repentis*, causal agent of tan spot of wheat

09:15 AM  **S. Amaike, and S.E. Strelkov.** Microscopic analysis of the interaction between Ptr ToxB-producing isolates of *Pyrenophora tritici-repentis* and toxin-sensitive and insensitive wheat

09:30 AM  **K. Dunfield, S. Srivastava, and N.N.V. Kav.** Characterization of PR 10.4 transgenic *Brassica napus*

10:00 AM  **Refreshment break**, Foyer

*Sponsored by Fisher Scientific*
Wednesday November 8th, 2006

Paper Session II  
Prairie Room – Chair: Tiesen Cao

10:30 AM  **S. Xue**, and S.E. Strelkov. Development of single spore isolation techniques for *Plasmodiophora brassicae*, causal agent of clubroot of crucifers

10:45 AM  **S. Xue**, R. Howard, M.H. Rahman, S.F. Hwang, and S.E. Strelkov. Variation in virulence of single spore-derived isolates of *Plasmodiophora brassicae* from Canada

11:00 AM  **Y.M. Kim**, and S.E. Strelkov. Activity of Ptr ToxB from virulent and avirulent isolates of *Pyrenophora tritici-repentis*


12:00 PM  **Lunch** – Glacier Room  
*Sponsored by BASF and 20/20 Seed Labs Inc.*
Wednesday November 8th, 2006
1:30 PM – 3:00 PM

Poster Session: Foyer

1) **P. Kathiria**, A. Boyko, F. Zemp, and I. Kovalchuk. Compatible plant pathogen interactions trigger various transgenerational responses


3) **Z. Navabi**, S.E. Strelkov, A. Good, M. R. Thiagarajah, and M.H. Rahman. Resistance to stem rot and black spot in a doubled-haploid population derived from an inter-specific cross between *Brassica napus* × *Brassica carinata*


5) **N. Sharma**, and N.N.V. Kav. Proteome-level responses during compatible and incompatible host-pathogen interaction

6) **Y. Liang**, S.E. Strelkov and N.N.V. Kav. Proteome-level changes in *Brassica napus* L. infected by *Sclerotinia sclerotiorum*


9) **M.R. McDonald**, B.D. Gossen, M.J. Celetti and G.J. Boland. Severity of powdery mildew on succulent and dry pea lines

10) **Y.M. Kim**, N.N.V. Kav, and S.E. Strelkov. Ptr ToxB-induced changes in the leaf proteome of toxin-sensitive wheat (*Triticum aestivum* L.)


12) **T.F. Wang**, B.D. Gossen, and A.E. Slinkard. Impact of lodging and foliar fungicide on severity of mycosphaerella blight and yield in field pea lines

14) **H. Khadhair**, C. Hiruki, and M. Deyholos. First record of molecular identification of aster yellows phytoplasma associated with valerian and sowthistle in Canada

15) **M. Harding**, L. Marques, M.E. Olson, and R.J. Howard. Biofilms are associated with vascular clogging and seed contamination by *Curtobacterium flaccumfaciens* pv. *flaccumfaciens* in bean vascular wilt

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**Wednesday November 8th, 2006**

3:00 PM  **Refreshment break**, Foyer  
*Sponsored by Chemtura*

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**Paper Session III**  
**Prairie Room – Chair: Peter Blenis**


4:15 PM  **D.A. Gaudet**, J.Y. Sun, Z.X. Lu, M. Frick, B. Puchalski, and A. Laroche. Lipid transfer proteins, their role in disease defence in wheat, and prospects for their use in disease control

4:30 PM  **N. Bouras**, F. Mathieu, N. Sabaou, and A. Lebrihi. Precursor-mediated biosynthesis of new dithiolopyrroline antibiotics by *Saccharothrix algeriensis*

4:45 PM  **M. Harding**, L. Marques, M.E. Olson, and R.J. Howard. Filamentous fungal biofilms: morphology, development and impact on disease management

5:00-7:00 PM  Free time

7:00 PM  **Banquet – Glacier Room**  
*Sponsored by Dow AgroSciences Canada*  
**Awards Presentation**
**Thursday, Nov. 9th**

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<tr>
<td>08:30 AM</td>
<td><strong>PPSA Business Meeting,</strong> Prairie Room</td>
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| 10:00 AM | **Refreshment break,** Foyer  
*Sponsored by Bayer CropScience and Syngenta Crop Protection Canada Inc.* |

**Paper Session IV**  
Prairie Room – Chair: Stephen Strelkov

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<tr>
<td>10:30 AM</td>
<td>S. Kotschorek, and K. Kenward. As we saw it: notes on seed-borne diseases of the 2005 harvest</td>
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<tr>
<td>11:00 AM</td>
<td>T. Cao, and B.C. Kirkpatrick. Almond leaf scorch disease development in almond scion stems high-worked on peach rootstock</td>
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<tr>
<td>11:15 AM</td>
<td><strong>Closing Remarks</strong></td>
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<tr>
<td>11:30 AM</td>
<td>Poster Removal</td>
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Tan spot, caused by Pyrenophora tritici-repentis Died., is an important foliar disease of wheat. The pathogen produces at least three host-specific toxins, including Ptr ToxB, a 6.6 kDa protein that causes chlorosis in sensitive wheat genotypes. Ptr ToxB is encoded by a multiple copy gene, termed ToxB, homologs of which have been identified in avirulent race 4 isolates of the fungus, as well as in low-virulence and virulent isolates of race 5. Expression of the ToxB gene was compared after inoculation of toxin-sensitive and insensitive wheat genotypes with isolates of races 4 or 5, using real-time PCR with TaqMan probes and an endogenous control. Analysis of the results using the comparative \( C_T \) method confirmed that ToxB transcript abundance was highest in leaf tissue inoculated with the virulent race 5 isolate, followed by the low-virulence race 5 isolate, and lowest after inoculation with the avirulent race 4 isolate. The overall pattern of ToxB gene expression was similar in the two race 5 isolates, but very different in the race 4 isolate. These results support the role of Ptr ToxB as an important pathogenicity factor for P. tritici-repentis.

Microscopic analysis of the interaction between Ptr ToxB-producing isolates of Pyrenophora tritici-repentis and toxin-sensitive and insensitive wheat. S. Amaike and S.E. Strelkov. Department of Agricultural, Food and Nutritional Science, 410 Agriculture/Forestry Centre, University of Alberta, Edmonton, AB T6G 2P5, Canada.

Tan spot, caused by Pyrenophora tritici-repentis Died., is an important foliar disease of wheat. Symptom development is associated with the production, by the fungus, of multiple host-specific toxins, including Ptr ToxB, a 6.6 kDa protein that induces chlorosis in sensitive wheat lines and cultivars. Using bright field, fluorescence and multi-confocal microscopy, the infection process was compared after inoculation of toxin-sensitive and insensitive genotypes with virulent and avirulent isolates of the fungus, which differ in their ability to produce Ptr ToxB. The number of appressoria produced differed significantly between a virulent race 5 isolate, a low virulence race 5 isolate, and an avirulent isolate of race 4, and was highest in the virulent isolate. Most appressoria formed by the race 4 isolate were produced on stomata, whereas most formed by the race 5 isolates developed on epidermal cell junctures. Formation of host papillae beneath the appressoria was observed in all host/isolate combinations. Although all three isolates were able to penetrate the epidermal cells and grow into the intercellular space of the mesophyll, the area of disrupted mesophyll was largest in the toxin-sensitive wheat tissue inoculated with the virulent race 5 isolate. These studies represent the first report of the histopathology of Ptr ToxB-producing isolates of P. tritici-repentis.

Narrow-leaved lupine (*Lupinus angustifolius* L.) has proven to be a successful pulse crop in Alberta. However, it is vulnerable to root rot infection caused by *Fusarium* spp. Field trials were established at Lacombe, Alberta, in early May, 2006 to assess the effect of seeding depth and seeding rate on seedling blight and root rot. Seed of the lupine cultivars ‘Arabella’ and ‘Rose’ were sown at 2.5-, 5.0-, 7.5- and 10.0-cm depths into soil inoculated with an aggressive isolate of *Fusarium avenaceum* (Fr.) Sacc. (originally isolated from lupine) and compared to a non-inoculated control. Inoculation reduced emergence only at the 10 cm depth. However, yield significantly declined with increased seeding depth for both cultivars, down to the 7.5 cm depth. In a separate trial, each cultivar was sown at a depth of 2.5 cm at rates of 150, 225, and 300 seeds/m². Emergence and yield were lower for both cultivars when seeded with 150 seeds/m² compared to 225 or 300 seeds/m². These trials will be repeated in 2007 to confirm the results before recommendations are made to producers.

**A little vinegar with your wheat? A potential fumigant for organic wheat.** T. Despins, D.A. Gaudet, B. Puchalski, P.L. Sholberg, and P. Randall. *Agriculture and Agri-Food Canada Lethbridge Research Station, Box 3000, Lethbridge, AB T1J 4B1, Canada.*

Common bunt caused by *Tilletia tritici* and *T. laevis* is an important pathogen of wheat. In common cultivation of wheat, fungicides such as Vitavax are useful for control of bunt. However, such fungicides are not permitted for use in organic wheat production. We assessed acetic acid fumigation as a potential control for common bunt in organic wheat. For three consecutive years, the highly susceptible variety Laura was inoculated to excess with bunt spores and fumigated with 2 and 4 g/kg acetic acid vapour in 23 L chambers for 1 hr. at 20°C. The seed was then planted in the field. Late in the growing season, plants were assessed for disease presence. Both treatments proved as effective as Vitavax for controlling bunt. The 4 g/kg treatment was more effective than the 2 g/kg treatment at reducing bunt infection, but resulted in fewer tillers overall, therefore reduced yield. Acetic acid fumigation also shows promise for controlling other seed borne pathogens.

**Characterization of PR 10.4 transgenic Brassica napus.** K. Dunfield, S. Srivastava, and N.N.V. Kav. *Department of Agricultural, Food and Nutritional Science, 410 Agricultural/Forestry Centre, University of Alberta, Edmonton, AB T6G 2P5, Canada.*

Abiotic stresses, such as cold, drought, and salinity, limit crop productivity throughout the world. Plant Pathogenesis Related (PR) 10 proteins may provide an avenue to increase the tolerance of crop plants to such abiotic stresses. Transgenic *Brassica napus* L. constitutively expressing pea PR 10.4 cDNA was developed in order to test the hypothesis that its expression provides increased germination and seedling vigor under abiotic stress conditions. Germination studies of transgenic and wild type lines were carried out on ½ M/S media and germination was recorded daily. The transgenic plants displayed a significant (*P > 0.05*) increase in percent germination when compared to the wild type at 5 °C and at room temperature with 275mM NaCl. Furthermore, a significant (*P > 0.05*) percentage of adult transgenic plants flowered earlier than the wild type. Two-dimensional gel electrophoresis was performed using pooled 2-week-old
seedling tissue of the wild type and transgenic lines. The expression of three proteins was found to be significantly altered; two of the proteins demonstrated at least a two-fold difference between the wild type and transgenic lines. These preliminary results indicate that pea PR 10.4 may offer an approach to increase the hardiness of B. napus and other crop plants.

Filamentous fungal biofilms: Morphology, development and impact on disease management. M.W. Harding, L.L.R. Marques, R.J. Howard, and M.E. Olson. Innovotech, Inc., BioSciences Building Rm. 025, 2500 University Dr. N.W., Calgary, AB T2N 1N4, Canada; and (R.J.H.) Crop Diversification Centre South, Alberta Agriculture, Food and Rural Development, 301 Horticultural Station Rd. E., Brooks, AB T1R 1E6, Canada.

Biofilms are highly structured microbial communities attached to a surface. The formation of microbial biofilms is now recognized as an important phenomenon in human, animal and plant diseases. These biofilms are much more resistant to environmental stresses and chemical treatments than microbial communities composed of solitary or planktonic cells. Observations such as these have created growing concerns in disease management and surface decontamination in medicine, industry and agriculture. Currently, very little is known about the ability of filamentous fungi to form biofilms. Our investigations have provided evidence that biofilms are the characteristic in planta morphology of fungal pathogens including Botrytis cinerea, Fusarium spp. and Verticillium spp. They are characterized by hyphal aggregation, layering and bundling, and are embedded in extracellular polymeric substances. In addition to in planta characterization, we have modeled fungal biofilm morphology and development in vitro using biofilm technologies developed by Innovotech, Inc. These technologies are also being used to measure any enhanced resistances of biofilms to various fungicides and disinfectants. We have demonstrated that fungal biofilms share many common characteristics with biofilm forms of bacteria and yeasts, including enhanced resistance to antimicrobials, and outline a model for the development of filamentous fungal biofilms.

Biofilms are associated with vascular clogging and seed contamination by Curtobacterium flaccumfaciens pv. flaccumfaciens in bean vascular wilt. M.W. Harding, L.L.R. Marques, R.J. Howard, and M.E. Olson. Innovotech, Inc., BioSciences Building Rm. 025, 2500 University Dr. N.W., Calgary, AB T2N 1N4, Canada; and (R.J.H.) Crop Diversification Centre South, Alberta Agriculture, Food and Rural Development, 301 Horticultural Station Rd. E., Brooks, AB T1R 1E6, Canada.

Bacterial wilt in bean is caused by Curtobacterium flaccumfaciens pv. flaccumfaciens (Cff). The disease is a serious problem for Alberta producers when environmental conditions favour the disease. Wilt pathogens such as Cff colonize the vasculature and form aggregates that cause clogging and subsequent wilting. They must withstand liquid shear forces and inhospitable conditions within conductive elements by attaching to plant surfaces and expressing stress tolerances. These conditions are known to induce the formation of microbial biofilms. Biofilms are complex organizations of microbial cells that are frequently encased in an extracellular matrix or ‘slime’. Biofilms have been associated with other vascular diseases such as potato ring rot, Pierce’s disease in grapes and citrus variegated chlorosis. Scanning electron micrographs showing the xylem of wilted bean plants revealed biofilms formed by Cff. The biofilms covered large areas and occasionally caused complete occlusion. Bean seeds showing typical wilt discoloration were also evaluated by SEM. Extensive biofilms were seen covering the seed surface with some evidence of bacteria inside the seed coat. Our results demonstrate that biofilms are likely an important part of the etiology and epidemiology of bacterial wilt disease. One
characteristic of many biofilms is an enhanced resistance to chemical treatments, therefore wilt disease management practices from seed treatments to pesticide sprays must be targeted to bacteria growing as biofilms in order to maximize efficacy.

**Evaluation of chemical disinfectants for use in sanitizing greenhouse surfaces.** M.W. Harding, S.L. Mobbs and R.J. Howard. Innovotech, Inc., BioSciences 025, 2500 University Dr. N.W., Calgary, AB T2N 1N4, Canada; (S.L.M, R.J.H.) Alberta Agriculture, Food and Rural Development, Crop Diversification Centre South, Alberta Agriculture, Food and Rural Development, 301 Horticultural Station Rd. E., Brooks, AB T1R 1E6, Canada.

Without pest management, pathogenic microorganisms can accumulate to harmful levels in greenhouse production systems. Fungal pathogens, such as *Fusarium* spp., *Botrytis cinerea* and *Pythium* spp., and bacterial pathogens, such as *Clavibacter michiganensis* and *Erwinia carotovora* can cause significant economic losses if allowed to multiply unchecked. A powerful tool in greenhouse pest management is sanitation. Sanitation encompasses both cleaning and disinfection of hard surfaces. Cleaning is necessary to remove organic material, such as soil, growing media and plant parts that can inactivate chemical disinfectants or provide a microenvironment where microbes survive. Applying a chemical disinfectant to clean surfaces can eradicate bacteria, fungi and spores and provide clean conditions necessary to establish new crops. In order to determine the effectiveness of a variety of chemical disinfectants, a research project was initiated that had the following goals: 1) To measure the effectiveness of nine chemical disinfectants for eradicating plant pathogenic fungi, bacteria and viruses; 2) To determine if efficacy is affected by surface materials (wood, metal, plastic, rubber, concrete), or the concentration of the disinfectant solution. 3) To determine the corrosive potential of chemical disinfectants on a variety of surface materials, and 4) Provide an assessment of any phytotoxic effects of chemical disinfectants a variety of plants. Each chemical disinfectant was ranked according to efficacy, corrosiveness and phytotoxicity.

**Evaluation of root pathogens of lupin (Lupinus angustifolius L.) in Alberta.** M.D. Holtz, K.F. Chang, S.F. Hwang, and S.E. Strelkov. Department of Agricultural, Food and Nutritional Science, 410 Agriculture/Forestry Centre, University of Alberta, Edmonton, AB, T6G 2P5, Canada; (K.F.C.) Field Crop Development Centre, Alberta, Agriculture, Food and Rural Development (AAFRD), 6000 C & E Trail, Lacombe, AB T4L 1W1, Canada; and (S.F.H.) Crop Diversification Centre North, AAFRD, 17507 Fort Road, Edmonton, Alberta, T5Y 6H3, Canada.

Narrowleaf lupin (*Lupinus angustifolius* L.) is being evaluated as a potential crop for production in Alberta. Root rot and seedling blight caused by *Fusarium* spp. may be a threat to this crop. The objective of this research is to evaluate the pathogenicity of fusaria, isolated from diseased narrowleaf lupins, to assess their potential for causing root rot and seedling blight. Two hundred and eighty-nine *Fusarium* cultures were isolated from diseased lupins in 2004 and 2006. Each *Fusarium* isolate was then grown as a pure culture on PDA media and used to inoculate twenty-five seeds of two cultivars, sown in a greenhouse. Seedling emergence, survival, root rot severity, and shoot and root dry weight were measured. Preliminary data from the experiment indicates that the cultivar Arabella is more susceptible to *Fusarium*-caused root rot and seedling blight than the cultivar Rose. There was a large variation in the virulence of the *Fusarium* isolates. The most virulent pathogens were tentatively identified as *Fusarium avenaceum* (Fr.) Sacc.
Compatible plant pathogen interactions trigger various transgenerational responses.
P. Kathiria, A. Boyko, F. Zemp, and I. Kovalchuk. Department of Biology, University of Lethbridge, Heplar Hall 129, 4401 University Drive, Lethbridge, AB T1K 7L9, Canada.
Plants receive biotic stress in form of pathogens. Infection with incompatible pathogens results in \( R \) gene mediated hypersensitive response, while infection with compatible pathogen leads to systemic spread. Much is understood about the incompatible pathogen interaction but the details of compatible interaction still remain largely unrevealed. Earlier it was reported that during a compatible interaction there is generation of systemic recombination signal (SRS) that is capable of spreading faster than virus and promoting changes in the frequency of somatic and meiotic recombination. The effect of this signal in the systemic tissue still remains to be investigated. To understand the transgenerational effect of the SRS more clearly, the progeny of pathogen-infected plants were analyzed. Global genome methylation revealed a significantly hypermethylated genome. In parallel, a differential pattern of methylation changes was observed. The \( R \) genes were significantly hypomethylated and the control loci were hypermethylated. By modifying methylation pattern, progeny of infected plant can delay the progression of pathogen in plant. Also, the frequency of rearrangements in \( R \) genes was higher than in control loci. It is hypothesized that the global genome hypermethylation is part of a plant mechanism to protect the genome, while the increased rate of rearrangements at specific loci due to the selective hypomethylation serves a role in increasing sequence variability. This mechanism can contribute to the evolution of large variability and specificity of \( R \) genes in plants.

During the summer of 2005, some lily plants showed unusual symptoms, particularly on the flowers. The symptoms were typical of virus or yellows-type diseases caused by phytoplasmas. In the fall of the same season, bulbs were collected from diseased and healthy lily plants and kept for six weeks in a cold room to break the dormancy. They were planted in a greenhouse at 25 °C with a photoperiod of 16 hours/day. The shoots were observed on a daily basis for growth and symptom development. Bulbs collected from healthy plants produced shoots two weeks earlier than those collected from diseased plants, and the shoots grew more rapidly. DNA was extracted from both healthy and diseased lily plants and subjected to a PCR assay using two universal primer pairs, which were designed to detect phytoplasma DNA in plant tissues. Amplicons were obtained from DNA of phytoplasma controls but not from DNA extracted from plants showing disease symptoms. However, by a dip-preparation method, transmission electron microscopy revealed the presence of flexuous virus particles, 680 nm in length, but no phytoplasmas in infected leaf and bulb scale tissues. This is the first report of a bulb-associated virus infecting Asiatic lily plants in Alberta.

Ptr ToxB-induced changes in the leaf proteome of toxin-sensitive wheat (\textit{Triticum aestivum} L.). Y.M. Kim, N.N.V. Kav, and S.E. Strelkov. Department of Agricultural, Food and Nutritional Science, 410 Agriculture/Forestry Centre, University of Alberta, Edmonton, AB T6G 2P5, Canada.
The fungus *Pyrenophora tritici-repentis* Died. causes tan spot, a major foliar disease of wheat, worldwide. The fungus produces at least three host-specific toxins, including Ptr ToxB, which induces chlorosis in sensitive host genotypes. In order to gain insights into the mechanism of toxin action, we examined proteome-level changes induced by hexahistidine-tagged Ptr ToxB in toxin-sensitive leaf tissue. Leaves of the wheat cv. Katepwa were infiltrated with toxin or water and changes in the proteome occurring 24 h after treatment were compared by 2-D gel electrophoresis. A total of 10 proteins were found to be significantly up-regulated in the Ptr ToxB-treated tissue and subjected to ESI-Q-TOF MS/MS. The identities of six of these proteins were established by MS/MS, and included proteins involved in stress/defense, photosynthesis and metabolism. Levels of the antioxidant enzyme superoxide dismutase (SOD) increased six-fold, suggesting an increase in reactive oxygen species (ROS) after treatment with the toxin. This finding seems to support previous research that suggested that Ptr ToxB-induced chlorosis may result from the formation of ROS, as a consequence of a direct or indirect inhibition of photosynthesis.

**As we saw it: notes on seed-borne diseases of the 2005 harvest.** S. Kotschorek, and K. Kenward. 20/20 Seed Labs Inc., #201 509-11 Ave, Nisku, AB T9E 7N5, Canada.

Seed-borne disease is a continuing threat to agricultural production in western Canada. Having monitoring systems in place to track pathogens such as *Fusarium graminearum* Schwabe, *Ascochyta* spp., and *Leptosphaeria maculans* L. is an important tool in predicting outbreaks and making informed cropping decisions. Seed health becomes increasingly important as crop rotations are squeezed and seed requirements are tightened. To that end, a survey of seed-borne disease results, as gathered during the 2005 harvest by an independent commercial seed testing laboratory, is presented. The correlation between harvest seed condition, location, and resulting seed-borne disease is discussed.

**Proteome-level changes in *Brassica napus* infected by *Sclerotinia sclerotiorum*.** Y. Liang, S.E. Strelkov, and N.N.V. Kav. Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB T6G 2P5, Canada.

Sclerotinia stem rot, which is caused by the necrotrophic fungal pathogen *Sclerotinia sclerotiorum* (Lib.) de Bary, is one of the most serious diseases of canola (*Brassica napus* L.) in the world. The objective of our study was to identify and characterize proteins involved in mediating this host-pathogen interaction using a proteomics-based approach. Necrosis of host tissue was observed 12h after inoculation with the pathogen and had spread considerably by 24h, suggesting that the time period between 12 and 24h after inoculation may be critical in the canola-*S. sclerotiorum* interaction. Leaf proteins were extracted at five time-points (6h, 12h, 24h, 36h, and 48h) and analyzed by 2D gel electrophoresis. A total of 34 proteins (12 up-regulated and 22 down-regulated) were identified by ESI-Q-TOF MS/MS. Some of the identified proteins are known to play regulatory roles in plant disease-signaling pathways, as well as roles in the response of plants to biotic and abiotic stress. Expression of genes encoding selected proteins will be validated using quantitative real-time PCR and their function in the canola-*S. sclerotiorum* interaction will be investigated further.

**Severity of powdery mildew on succulent and dry pea lines.** M.R. McDonald, B.D. Gossen, M.J. Celetti and G.J. Boland. University of Guelph, Department of Plant Agriculture, Guelph, ON N1G 2W1, Canada; (BDG) Saskatoon Research Centre, Agriculture and Agri-Food Canada, 107 Science Place, Saskatoon, SK S7N 0X2, Canada; (MJC) Ontario Ministry of Agriculture and
Powdery mildew of pea, caused by *Erysiphe pisi* Syd., is an important constraint to production of succulent peas in Canada, and an occasional problem on field peas. Field trials were conducted in Ontario and Saskatchewan to assess the reaction of pea lines to powdery mildew and ascochyta blight (caused primarily by *Mycosphaerella pinodes* (Berk. & Blox.) Vestergr.). Powdery mildew developed at the Ontario site in 2004 and in Saskatchewan in 2005. Disease severity was assessed at pod filling on 3 and 4 lines of field peas and 5 and 20 lines of succulent peas in 2004 and 2005, respectively. Ten plants per plot were rated using a modification of the 0 – 9 scale developed by Xue et al. (1996). Reaction to powdery mildew was consistent among the seven lines that were tested in both years. Powdery mildew severity ranged from 0.5 - 6.3 in Ontario and 0.3 - 4.9 in Saskatchewan. The varieties ‘Genie’, ‘Mr.Big’ and ‘Durango’ were resistant to powdery mildew, ‘Estancia’ and ‘Miami’ were susceptible, and several lines showed an intermediate reaction. ‘Durango’ also exhibited some resistance to ascochyta blight. Pea lines with resistance to both diseases would be beneficial for the industry.

Resistance to stem rot and black spot in a doubled-haploid population derived from an inter-specific cross between *Brassica napus* × *Brassica carinata*. Z. Navabi, S.E. Strelkov, A. Good, M.R. Thiagarajah, and M.H. Rahman. Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, T6G 2P5, Canada; and (A.G.) Department of Biological Sciences, University of Alberta, Edmonton, AB T6G 2E9, Canada.

Stem rot (caused by *Sclerotinia sclerotiorum* (Lib.) de Bary) and black spot (caused by *Alternaria brassicae* (Berk.) Sacc.) are important fungal diseases of canola (*Brassica napus* L.), causing significant yield losses worldwide. Sources of resistance to either of these diseases have not been reported in *B. napus*. However, accessions of *Brassica carinata* L. have been identified with high levels of resistance to both diseases. In order to transfer resistance to *B. napus*, a doubled-haploid (DH) population from BC₂ lines derived from a *B. napus × B. carinata* interspecific cross was developed. Sixty lines were screened in the greenhouse for resistance to stem rot and black spot. The *B. napus* parent (‘Westar’) and all *B. napus* controls showed a susceptible response to both diseases, while the *B. carinata* parent was resistant to both diseases. The DH lines were significantly different in their response to both diseases. Moderate broad-sense heritability was estimated for diseased leaf area, caused by *A. brassicaceae*, \( h^2_{bs} = 0.45 \), while *S. sclerotiorum* lesion length appeared to have lower heritability \( h^2_{bs} = 0.22 \). We were able to identify DH lines that repeatedly expressed high levels of resistance to both diseases over multiple rounds of disease testing.


Stripe rust *Puccinia striformis* is an important pathogen in wheat world-wide. Historically stripe rust infections in Alberta have been sporadic but since 2003, stripe rust infections have became more prevalent and damaging due to a change in the pathogen’s physiology that allows it to be infective under warmer conditions. In 2006 we initiated a study to develop protocols for the establishment and rating of artificially inoculated nurseries. Inoculation consisted of transplanting greenhouse-reared, infected plants to wheat nurseries or applying talcum:spores 20:1 as a dust to the wheat plots prior to anthesis. Rating consisted of taking three observations, at the boot, anthesis and at mid dough. Other parameters considered
important were the amount of leaf surface area lost to infection or hypersensitivity, and the time interval the rust is actively sporulating. Natural infections had produced significant yield losses in winter wheat by June 25 in the Medicine Hat area but damaging levels were not observed in Lethbridge until July 16. Among field plots, artificial infestation produced epidemic levels of stripe rust two weeks earlier than the natural infestation. Transplantation of the infected plants produced the most uniform and consistent data and required considerably less inoculum than the talcum spore procedure. Among the 57 Canadian spring wheat and triticale cultivars evaluated, the majority of varieties were susceptible but the average resistance among triticales, durums and extra strong wheats was excellent. In cultivars where *LR34/Yr18* occurred in semi-dwarftypes, levels of rust infection were considerably higher than that observed where the same gene occurred in varieties of conventional height. The genes conferring resistance among the durums are unknown.

**Fungal proteins involved in the interaction between wheat and the snow mold fungus.** B. Puchalski, W. Zhou, B.J. Puchalski, D. Gaudet, F. Eudes, and A. Laroche. *Agriculture and Agri-Food Canada, Lethbridge Research Station, Box 3000, Lethbridge, AB T1J 4B1, Canada; and (B.P.) Winston Churchill High School, Lethbridge, AB T1H 1W4, Canada.* Cultivation of over-wintering crops on the Prairies is hampered by the occurrence of low temperature plant pathogens known as snow moulds that injure plants under the snow cover. Our hypothesis is that some factors are induced in snow moulds as they interact with their host. To verify this hypothesis, we developed an in vitro system to mimic natural infection conditions for the snow mould fungi on winter wheat plants. In order to identify early-induced proteins, fungal mycelia in contact with wheat, or not, were harvested after 5 days at -3°C. Total proteins were isolated and resolved on 2-D gels. Six proteins were detected to be unique in the fungal sample exposed to wheat. The molecular size and isoelectric point of these polypeptides ranged from 15 to 68 kDa and from 6.0 to 6.8 pH units. They were further analyzed by LC-MS/MS and the derived sequences searched against different databases for identification. A 1-aminocyclopropane-1-carboxylate deaminase, an enzyme that metabolizes ethylene, a plant growth factor and signal transduction molecule, may be involved in inactivation of plant defense mechanisms was identified. Four other proteins appear to be novel as no corresponding sequences could be found in public databases so far. A second replication where an additional 4 up-regulated and 2 down-regulated proteins were identified, excised. Analysis by LC MS/MS indicated that these 6 new proteins were also novel to this fungus. Inconsistencies occurred between the first and second gels and a third gel and LC MS/MS is required for confirmation of the identified proteins.

**Proteome-level responses during compatible and incompatible host-pathogen interactions.** N. Sharma, and N.N.V. Kav. *Department of Agricultural, Food and Nutritional Science, University of Alberta. Edmonton, AB T6G2P5, Canada.* Plants are constantly being challenged by potential pathogens and have evolved several strategies to withstand harmful attacks. To gain a better understanding of the early events that occur after pathogen attack in a compatible (susceptible) interaction as well as in an incompatible (resistant) interaction, we employed a proteomics-based approach. Blackleg disease caused by *Leptosphaeria maculans* (Desmaz.) Ces. & DeNot. is a destructive disease of canola (*Brassica napus* L.) and causes economic losses due to reduction in both yield and quality. Although resistant cultivars have been developed to reduce incidence and severity of blackleg disease, the understanding of molecular mechanisms underlying the incompatible interaction is limited. In the current study, two-dimensional gel electrophoresis was performed using protein extracts from
leaves infected with the pathogen and were compared with control protein extracts. Fifteen protein spots were observed to be significantly altered in expression during early interaction (6 and 12 hours) following pathogen infection of the leaves of *Brassica carinata* L. (resistant to blackleg) and two in *B. napus* (susceptible to blackleg). Tandem MS/MS analysis was used to identify these differentially-expressed proteins. This study demonstrates the feasibility of using proteomics for the identification of differentially-expressed proteins, and provides insights into the complex regulatory networks involved during host-pathogen interactions in blackleg disease of canola.

**Occurrence of clubroot on canola in central Alberta in 2006.** S.E. Strelkov, V.P. Manolii, T. Cao, S.F. Hwang, and D. Orchard. *Department of Agricultural, Food and Nutritional Science, University of Alberta. Edmonton, AB T6G2P5, Canada; (S.F.H.) Crop Diversification Centre North, Alberta Agriculture, Food and Rural Development, 17507 Fort Road, Edmonton, AB T5Y 6H3, Canada; and (D.O.) Sturgeon Valley Fertilizer Ltd., P.O. Box 292, Station Main, St. Albert, AB T8N 1N3, Canada.*

In August and September 2006, 250 commercial canola (*Brassica napus* L.) fields in central Alberta were surveyed for the occurrence of clubroot, caused by the obligate parasite *Plasmodiophora brassicae* Woronin. Fields were surveyed after swathing. The roots of all plants within a 1 m² area at nine sampling points were inspected for disease development. The sampling points were at the field entrance and 150 and 300 m distant along each of four lines radiating from the entrance. A total of 71 clubroot-infested canola fields were identified, with the majority located in Sturgeon, Parkland and Leduc counties. A number of infested fields were also identified in a rural area of northeast Edmonton, as well as in Strathcona County. In most fields, disease distribution was patchy and severity was light to moderate. However, at least 13 fields were heavily infested, including one in which clubroot was so severe that the canola crop was not harvested, and hence a 100% loss occurred. The 71 fields identified in 2006 represent newly discovered cases of the disease, and bring to 113 the total number of fields now known to be infested with clubroot in central Alberta.

**Impact of lodging and foliar fungicide on severity of mycosphaerella blight and yield in field pea lines.** T.F. Wang, B.D. Gossen, and A.E. Slinkard *Department of Plant Sciences, University of Saskatchewan Saskatoon, SK S7N 5A8, Canada; (BDG) Agriculture and Agri-Food Canada, Saskatoon Research Centre, Saskatoon, SK S7N 0X2 Canada.*

The objective of this study was to assess the impact of lodging and foliar fungicide (3-4 applications of chlorothalonil) on the severity of mycosphaerella blight caused by *Mycosphaerella pinodes* (Berk. & Blox.) Vestergr., and on seed yield and 1000-seed weight of 10 field pea (*Pisum sativum* L.) genotypes. The test was conducted under irrigation at Saskatoon and Outlook SK for two years. Lodging was reduced by having the crop grow up through a wire mesh supported 30 cm above the ground. Blight severity on stems, foliage, and pods was rated 3 to 4 times per year. The effects of reduced-lodging and fungicide were additive; both treatments reduced blight severity and increased seed yield and weight. Early lodging was associated with the largest reductions in seed yield and seed weight. Application of foliar fungicide had a smaller impact and was likely not cost-effective in most years. Small but significant differences in disease severity were present among the field pea lines, verifying the presence of partial resistance. We conclude that losses caused by mycosphaerella blight may be reduced by breeding for improved resistance to lodging, and that breeding for partial resistance may also hold promise.
Evaluating pea genotypes for resistance to powdery mildew in Alberta. H. Wang, S.F. Hwang, P. Kharbanda, P. Watson, B.D. Gossen, and R.J. Howard. Alberta Research Council, Vegreville, AB T9C 1T4, Canada; (S.F.H.) Crop Diversification Centre North, Alberta Agriculture, Food and Rural Development, Edmonton, AB T5Y 6H3, Canada; (B.D.G.) Agriculture and Agri-Food Canada, Saskatoon Research Centre, Saskatoon, SK S7N 0X2, Canada; and (R.J.H.) Crop Diversification Centre South, Alberta Agriculture, Food and Rural Development, Brooks, AB T1R 1E6, Canada.

In a survey of field pea (Pisum sativum L.) fields in central Alberta in 2006, powdery mildew (Erysiphe pisi L.) was observed in all 22 commercial fields surveyed. Varietal resistance is the most effective and economical means for successful disease management. To assess the reaction of pea genotypes to powdery mildew, 39 pea lines were evaluated in a field experiment and 49 lines were assessed in a greenhouse trial. Ten genotypes (JI96, ‘CDC Montero’, ‘DS Admiral’, ‘Carneval’, ‘Eclipse’, ‘CDC Handel’, ‘Highlight’, ‘CDC Minuet’, ‘CDC Mozart’, and ‘SW Salute’) displayed consistent resistance, with disease severity scores less than 5 (equivalent to 1-36% of leaf area with symptoms) on a 0-10 scale in both greenhouse and field evaluations. Susceptible genotypes had an average severity score of 10 in the greenhouse at 7 wk after seeding, and between 7 and 10 in the field. However, inconsistent results were observed in ‘Vantage’, which was highly susceptible in the greenhouse but moderately resistant in the field. Under controlled environment, seven susceptible or moderately resistant cultivars/lines were analyzed for disease progression. Mildew developed rapidly at 4-5 wk after seeding on four of these lines. However, the disease developed more slowly on PI806922 and ‘Eiffel’, and much more slowly on line JI96.

Variation in virulence of single spore-derived isolates of Plasmodiophora brassicae from Canada. S. Xue, R.J. Howard, M.H. Rahman, S.F. Hwang, and S.E. Strelkov. Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB T6G 2P5, Canada; (R.J.H.) Crop Diversification Centre South, Alberta Agriculture, Food and Rural Development (AAFRD), S.S #4, Brooks, Alberta T1R 1E6, Canada; and (S.F.H.) Crop Diversification Centre North, AAFRD, Edmonton, AB T5J 4K3, Canada.

The variation in virulence of single spore-derived isolates of Plasmodiophora brassicae Woronin from Canada was compared by inoculation onto the differential hosts of Williams. Five single spore isolates were tested from each of five previously characterized field populations of the pathogen, including SACAN03-1, Leduc-1, ORCA04, AbotJE04-1 and CDCN04-1. All single spore isolates derived from SACAN03-1 had identical virulence patterns and were classified as pathotype 3, the same classification reported for the field population. Similarly, all single spore isolates from AbotJE04-1, which was pathotype 6, also shared the same virulence pattern and were classified as pathotype 6. In contrast, the other three populations seemed to consist of pathotype mixtures. For example, while field population Leduc-1 was classified as pathotype 3, single spore isolates derived from that population belonged to pathotypes 3 and 6. These results seem to support previous suggestions that field populations of P. brassicae may consist of pathotype mixtures, and that use of populations for pathogen characterization may fail to detect rare pathotypes.
Business Meeting Agenda – 27th Annual Meeting

November 9, 2006  Lister Conference Centre  University of Alberta

Prairie Room (8:30 – 10:00 a.m.)

President - Stephen Strelkov
Secretary-Treasurer – Peter Blenis

Items
1. Adoption of the Agenda
2. Adoption of the Minutes of the 2005 PPSA Annual Meeting, Canmore, AB
3. Interim Financial Report - Noryne Rauhala
4. Reports of Standing Committees
5. Conference Reports
6. Reports on Unusual or Exceptional Disease Situations
7. Nomination of Honorary Life Members
8. Resolutions
9. Locations and Dates of Future Meetings
10. Election of Officers for 2006-07
11. Other Business
12. Adjournment
Minutes from the Business Meeting – 27th Annual Meeting

November 9, 2006  Lister Conference Centre  University of Alberta

Prairie Room (8:30 – 10:00 a.m.)

President - Stephen Strelkov
Secretary-Treasurer – Peter Blenis

1. Adoption of agenda.
   There were no changes or amendments.
   ➢ Motion: adoption of agenda. Moved by Ron Howard, seconded by Julie Bernier, motion approved.

2. Adoption of 2005 minutes.
   There were no changes or amendments.
   ➢ Motion: adoption of minutes. Moved by Ron Howard, accepted by Mike Harding, motion approved.

3. Interim financial report.
   A presentation was made by Noryne Rauhala. She indicated that two GICs will mature at the end of December and so it would be necessary to decide what to do with these. It was also noted that with the retirement of Denise Orr, someone else would need to have signing authority.
   ➢ Motion: signing authority should be held both by Noryne Rauhala and Kelly Turkington. Moved by Denis Gaudet, seconded by Julie Bernier, motion approved.
   ➢ Motion: $4000 should be invested into a three-year GIC and $1000 should be invested into a redeemable instrument. Moved by Noryne Rauhala, seconded by Denis Gaudet, motion approved.
   ➢ Motion: adopt financial report provided by Noryne Rauhala. Moved by Noryne Rauhala, seconded by Ron Howard, motion approved.

4. Historical Committee.
   The proposed terms of reference for the Historical Committee were provided by Steve Strelkov. In particular, it was noted that members will serve until resignation or until the committee is disbanded.
   ➢ Motion: adopt Steve Strelkov's terms of reference. Moved by Steve Strelkov, seconded by Ron Howard, motion approved.

It was noted that three members are required. Currently Steve Strelkov and Byron Puchalski are serving. Denis Gaudet volunteered to be the third member.

Denis Gaudet indicated that it was important for individuals nearing retirement to consider archiving materials that might be of interest. He also suggested that materials from previous meetings could be forwarded to the Historical Committee.
Ron Howard indicated that if anyone had historical material, especially photographs or artifacts, they could be sent to the Historical Committee. Kevin Zaychuk suggested that once these materials have been gathered together it might be valuable to have a presentation at the PPSA meeting to describe what materials have been archived, and indicate gaps in archived materials.

5. **Awards Committee.**

Terms of reference for the Alberta Graduate Student Scholarship Award were presented by Denis Gaudet. He proposed that recipients receive a certificate, a signed letter from the president of PPSA and $500. After some discussion, it was proposed that it would not be necessary to provide a plaque. All full-time graduate students at an Alberta University or college or students at other universities or colleges doing research primarily in Alberta would be eligible. Any individual student could not receive the award more than once while they were doing a single degree but they could receive the award multiple times if they were doing multiple degrees. The recipient would be determined by members of the Awards Committee. Applicants must submit a one-page introductory letter from their advisor (together with their curriculum payday) forwarded to the awards committee by October 1. A student would not have to be a member of PPSA to be eligible for this award.

- Motion: Adopt the terms of reference. Moved by Denis Gaudet, seconded by Ron Howard, motion approved.

Terms of reference for the best student presentation award were presented by Denis Gaudet. He proposed that two awards be given, one for an oral presentation, and a second for a poster. Previous references to granting two awards in the case of a tie would be eliminated. Recipients would receive a certificate, a signed letter of acknowledgment from the PPSA president, a cash award of $50 and a waiver of the registration fee for the meeting. All full-time graduate students at an Alberta University or college or students at other universities or colleges doing research primarily in Alberta would be eligible.

- Motion: adopt the terms of reference. Moved by Denis Gaudet, seconded by Julie Bernier, motion approved.

Terms of reference for the best presentation by a technician were presented by Denis Gaudet. There was some discussion of whether this award should be given, but on the basis of a straw vote, it was determined that the majority were in favor of having this award. It would be given for the best oral presentation or poster; in the event of a tie, two awards could be given. Recipients would receive a signed certificate from the president and a $50 award. Those wishing to be considered for this award should identify themselves at the time of registration. All plant pathology technicians who are members of good standing in PPSA would be eligible.

- Motion: adopt the terms of reference. Moved by Denis Gaudet, seconded by Bruce Gossen, motion approved.

6. **Disease survey committee.**

It was proposed that discussion of the terms of reference should wait until next year when Kelly Turkington would be present.

- Motion: defer discussion of terms of reference. Moved by Steve Strelkov, seconded by Ron Howard, motion approved.
7. **Conference reports.**
   Ron Howard indicated that he could provide copies of the summary of the Western Committee on Plant Diseases. Bruce Gossen reminded us of the upcoming plant Canada meeting in Saskatoon.

8. **Unusual or exceptional situations.**
   None were noted.

9. **Honorary life members.**
   Ron Howard nominated Denise Orr, for the title of honorary life member, based on her long-standing service to the society since its inception.
   ➢ Motion: Denise Orr be made an honorary life member of PPSA. Moved by Ron Howard, seconded by Denis Gaudet, motion approved.

10. **Resolutions.**
    The organization committee of Steve Strelkov, Sharon Katzef and Peter Blenis were thanked for their efforts.
    ➢ Moved by Ron Howard, seconded by Sherry Lisowski, motion passed.

11. **Future meetings.**
    ➢ Next year's meeting will be in Lethbridge between the sixth and eighth of November; the following year's meeting will be in Lloydminster.

12. **Officers.**
    The new officers will be as follows. President: Denis Gaudet; Vice President: Jiang Yang; Secretary/Treasurer: Andre Larouche; Regional Representatives: Julie Bernier, Michael Harding, Shauna Kotschorek.
    ➢ Moved by Denis Gaudet, seconded by Ron Howard, motion approved.

13. **Other business.**
    ➢ Motion: the secretary-treasurer should work with CPS to determine if we can have space on their website to announce future sites, awards, other information related to PPSA, etc.. Moved by Ron Howard, seconded by Kevin Zaychuk, motion approved.

14. **Motion: adjournment.**
    ➢ Moved by Steve Strelkov, seconded by Sherry Lisowski.
Terms of Reference
Historical Committee
Plant Pathology Society of Alberta

Objectives
The historical committee will have as its main objectives the preservation of the history of the Plant Pathology Society of Alberta (PPSA), and more generally, the history of the discipline of plant pathology in the province.

Activities
Ensure proper archiving of important documents (including meeting programs, proceedings, photographs, etc.) at the University of Alberta. Information from this archive will be provided to interested parties as requested.

Membership
The membership of the Historical Committee shall consist of the Chair and two other volunteers, all of whom shall also be members of the PPSA. Members of this committee will serve until their resignation or until the committee is officially disbanded by the Board.

Responsibilities
The Historical Committee shall endeavour to meet the objectives stated above. The committee will meet in conjunction with annual meetings of the PPSA or via conference calls as required. The Chair will be responsible for preparing an annual report on meeting activities.
### Officers of the Plant Pathology Society of Alberta

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### Standing Committees

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