CANADIAN PHYTOPATHOLOGICAL SOCIETY

MARITIME REGION MEETING 2005

Potato Research Centre, AAFC, 850 Lincoln Road, Fredericton, New Brunswick

December 1, 2005

Canadian Phytopathological Society
Maritime Region Meeting
December 1, 2005
Potato Research Centre, Fredericton, NB

INTRODUCTION

Welcome to Fredericton and to the 2005 Canadian Phytopathological Society Maritime Region Meeting. It has been a full year since we got together as a group, and I look forward to a stimulating afternoon of scientific discussion and fellowship.

There are 13 oral presentations on various topics in phytopathology scheduled for the afternoon. A dinner and presentations will take place at the Blue Door in downtown Fredericton following the meeting.

I am pleased to welcome Agnes Murphy, research scientist with Agriculture and Agri-Food Canada in Fredericton, as our keynote speaker. Agnes is well-known for her work on host resistance and cultivar development. She completed degrees in Biology and Plant Pathology at Memorial University and the University of Guelph, respectively. Agnes joined AAFC in Fredericton in 1982. She currently co-ordinates a program in screening for disease resistance as it relates to potato breeding and assessing plant health in breeding stocks. Her presentation is entitled: "**Plant pathology and potato breeding: interlaced disciplines**".

Many thanks to all who attended the meeting. I would particularly like to thank Dr. Xianzhou Nie, AAFC, Fredericton and his assistants for hosting this year's meeting and taking on the responsibilities of organizing the meeting, scheduling the presentations and preparing the book of abstracts. I would also like to thank the Canadian Phytopathological Society, represented by president André Lévesque, for sponsoring this event. I trust we will be able to get together on a regular basis in future, and on that note, Gordon Braun has agreed to host the 2006 meetings in Nova Scotia.

This booklet contains abstracts of the 13 oral presentations in the order that they were presented. All abstracts will subsequently be published in an upcoming edition of the Canadian Journal of Plant Pathology. The research work represented by these papers forms an important part of the on-going development of phytopathological research in the Maritimes.

Rick D. Peters
Maritime Region Rep
Canadian Phytopathological Society

Canadian Phytopathological Society - Maritime Region Meeting 2005
Scientific Program

Thursday, 1st December 2005
Conference Room, Potato Research Centre

13:00-13:10 **Introduction/Welcome**: **Rick D. Peters**, CPS Representative - Maritime Region

13:10-13:55 **Keynote Speaker: Agnes Murphy**, Research Scientist, Potato Research Centre, AAFC, Fredericton, NB.
Plant Pathology and Potato Breeding: Interlaced Disciplines.

Session A: Host-pathogen interactions

13:55-14:10 Viroids from ornamental plants: a potential threat to tomato and potato crops**.**
R. P. Singh

14:10-14:25 Host-pathogen interactions of various combinations of *Verticillium* species inoculum in potato. **(Student paper, competition)**
N. Robinson, H. W. (Bud) Platt, L. Hale, and V. MacLean

14:25-14:40 Potato gene expression during infection of tubers by *Streptomyces scabiei*.
C. Goyer, and J. Zeng

14:40-14:55 The sensitivity to mefenoxam of Canadian strains of *Phytophthora erythroseptica*, causal agent of potato pink rot, and their interactions with *P. infestans* in tubers.
(Student paper, competition)
P. D. Young, R. D. Peters, H. W. (Bud) Platt, and L. R. Hale.

14:55-15:10 Systemic acquired resistance against *Potato virus Y* in tobacco is salicylate-mediated and ethylene independent.
X. Nie

15:10-15:40 **Nutrition Break**

Session B: Pathogen detection and disease diagnosis

15:40-15:55 Real-Time PCR assay for the detection of potato viruses in a triplex format.
M. Singh, R. P. Singh, and R. Coffin

15:55-16:10 Viroid RNAs, PCR fragments and plasmid purification simplified by spotting an alkaline extract onto nitrocellulose membrane.
R. P. Singh, A. D. Dilworth, M. Singh, and K. M. Babcock

Session C: Disease management

16:10-16:25 Suppression of potato (*Solanum tuberosum*) early blight (*in vivo*) and germination of *Alternaria* spp. conidia (*in vitro*) with strobilurin fungicides. **(Student paper, competition)**
W. MacDonald, R. D. Peters, R. H. Coffin, and C. Lacroix

16:25-16:40 Evaluation of at-planting in-furrow application of Phostrol and Ridomil Gold 480EC for potato pink rot control.
K. I. Al-Mughrabi, and R.D. Peters

16:40-16:55 Biological control of apple replant disease.
P. G. Braun, and K. K. Fuller

16:55-17:10 Increasing the sustainability of potato production in Atlantic Canada with crop rotation and conservation tillage.
R. D. Peters, M. R. Carter, J. B. Sanderson, and A. V. Sturz

17:10-17:25 Re-assessment of the presence of *Pospiviroid* species in floral parts using RT-PCR and infectivity assays.
R. P. Singh

17:25-17:50 **Wrap-up**

19:00- **Dinner and Award Presentations (The Blue Door, Downtown Fredericton, corner of Regent and King - *to be confirmed*)**

Note to presenters: Please ensure that your presentation is given to the audio/visual co-ordinator at least 1 hour prior to the start of the session

Keynote Speaker
13:10-13:55

Plant pathology and potato breeding: interlaced disciplines

Agnes Murphy

Potato Research Centre, AAFC, P.O. Box 20280, 850 Lincoln Road, Fredericton, NB E3B 4Z7, Canada.

Potatoes are susceptible to many diseases, some of which are amenable to control through breeding efforts. For some pathogens, other economically or environmentally acceptable means to limit losses from disease are not available and breeding for resistance is the only practical option.

This presentation will address the role of plant pathologists in the quest for new potato cultivars that have improved disease resistances combined with acceptable agronomic and quality traits for their end use. Starting with the germplasm resource and the identification of new sources of disease resistance, through the improvement of parents and concluding with the cultivar description, pathologists provide information and work with breeders at every step in the multi year process. The decision to advance selections for further evaluation is made only after thorough review of all available data and records pertaining to agronomic and quality attributes plus reaction to diseases. Only those that meet performance thresholds make the cut.

In the potato breeding cycle, just the first generation is grown from botanical seed. All successive generations are propagated vegetatively, as is the case in commercial production. Thus, the assurance of plant health is another aspect for attention. Breeding stocks are subjected to diagnostic tests and visual inspections to ensure freedom from disease since a proportion of these selections are multiplied and shipped for evaluation trials across the country.

The presentation is based primarily on the experience and perspective of a pathologist tightly woven into the fabric of the potato breeding program at the AAFC Potato Research Centre.

Session A: Pathogen-host interactions
13:55-14:10

Viroids from ornamental plants: a potential threat to tomato and potato crops

R. P. Singh
Potato Research Centre, 850 Lincoln Road, Fredericton, NB, E3B 4Z7, Canada

Ornamental plant nurseries play a significant role in the aesthetic landscape of urban and rural centres. Flowers and foliage plants, shrubs, plants for hanging baskets, and landscapes from all regions of the world are available at ornamental plant nurseries. A variety of plant species, lack of isolation between plant species, rapid vegetative multiplication (mainly by cuttings), and an absence of disease-symptoms in propagating material, render nurseries as an ideal environment for viroid evolution through recombination and mutation. Although only scattered reports of viroids from ornamental plants have been made, it has been shown that viroids persisting symptomlessly in ornamental plants can cause severe economic losses upon transfer to crop plants. A study of species-jumping of *Columnea latent viroid* probably from an ornamental plant to tomato in nature, its manual transfer to potato and growth under field conditions in the Netherlands will be discussed. It has demonstrated that *Columnea latent viroid* caused high infection rate in the tomato crop and a very high reduction of the potato tuber yield. Also, the potential of developing multiple viroid infections through recombination in vegetatively propagated plants and experimental demonstration of 'inverse' chimeric viroid formation are other examples of the role played by ornamental plants in viroid evolution.

Session A: Pathogen-host interactions
14:10-14:25

Host-pathogen interactions of various combinations of *Verticillium* species inoculum in potato

N. Robinson, H. W. (Bud) Platt, L. Hale, and V. MacLean

Crops and Livestock Research Center, Agriculture and Agri-Food Canada, 440 University Avenue, Charlottetown, PEI, C1A 4N6, Canada; and (L.H.) Department of Biology, University of Prince Edward Island, 550 University Avenue, Charlottetown, PEI, C1A 4P3, Canada

Verticillium wilt can cause significant tuber yield losses in many potato growing areas worldwide. *Verticillium* spp. are soil or tuber borne and are often found in association with many other microorganisms including other *Verticillium* spp. The population dynamics following combined inoculations of potato with various *Verticillium* spp. were studied. In greenhouse and field studies, four *Verticillium* spp. were used: *V. albo-atrum* 'group 1', *V. dahliae*, *V. albo-atrum* 'group 2' and *V. tricorpus*. Potato plants were inoculated with two out of the four species in various combinations of an aggressive (*V. albo-atrum* 'group 1' or *V. dahliae*) and weak (*V. albo-atrum* 'group 2' or *V. tricorpus*) pathogen on the same date or with a weak species followed by an aggressive species four days later. Soil samples and various plant parts were collected and relative population levels (RPLs) of each pathogen were determined using polymerase chain reaction (PCR) techniques. In combinations where pathogens were inoculated at the same time, the weaker species did not suppress RPLs of the aggressive species. In combinations where the weaker species were inoculated first, followed by the aggressive species four days later, the two weaker species were able to suppress RPLs of V. *albo-atrum* and visual wilt symptoms of both *V. dahliae* and *V. albo-atrum* 'group 1'.

Session A: Pathogen-host interactions
14:25-14:40

Potato gene expression during infection of tubers by *Streptomyces scabiei*.

C. Goyer, and J. Zeng

Agriculture and Agri-Food Canada, Potato Research Centre, P.O. Box 20280, 850 Lincoln, Fredericton, NB E3B 4Z7, Canada

Streptomyces scabiei is a soil-borne bacterium that infects growing potato tubers by entering through the lenticels or wounds. Brownish lesions appear on the tubers that can be raised, superficial or deep-pitted. Although several potato lines or cultivars are resistant to common scab, the mechanisms involved are still unknown. The objective of this project was to study the expression of genes from potato tubers infected by *S. scabiei*. Non-infected and *S. scabiei* infected leaf bud tubers from the diploid resistant line of potato 12120-03 were used to build a subtractive cDNA library. The resulting pool of genes was also normalized to increase rare genes by removing the two most frequent DNA fragments using Southern blot. Approximately 200 DNA fragments resulting from the subtraction were cloned, sequenced and assembled into 19 contigs. Sequences from five contigs were similar to cysteine proteases, one contig to a pectate lyase, three contigs were similar to EST sequences and 10 contigs contained sequences that were not similar to any other known sequences.

Session A: Pathogen-host interactions
14:40-14:55

The sensitivity to mefenoxam of Canadian strains of *Phytophthora erythroseptica*, causal agent of potato pink rot, and their interactions with *P. infestans* in tubers.

P. D. Young, R. D. Peters, H. W. (Bud) Platt, and L. R. Hale

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Mefenoxam is the only chemical control currently registered in Canada for *Phytophthora erythroseptica*, the causal agent of pink rot of potato. In recent years, mefenoxam-resistant strains of *P.erythroseptica* have been recovered in potato-producing states such as Idaho and Maine, U.S.A. Development of pink rot in fields that have been treated with mefenoxam has brought the utility of this fungicide into question. In addition, the impact of the presence of late blight in conjunction with pink rot in field and stored tubers on the efficacy of mefenoxam is unknown.We have undertaken the first Canada-wide survey for mefenoxam resistance in strains of *P. erythroseptica*. Tubers with pink rot were obtained from fields throughout Canada. The pathogen was then isolated and tested for sensitivity to mefenoxam at various concentrations using an *in vitro* agar assay. Sensitive strains of *P. erythroseptica* were tested for their interactions with *P. infestans* in both *in vitro* and *in vivo* experiments. The *in vitro* experiment involved growing a mefenoxam-sensitive isolate of *P. erythroseptica* in a broth medium containing mefenoxam that had previously served as a substrate for the *in vitro* growth of a mefenoxam-resistant strain of *P. infestans*. The *in vivo* experiment involved inoculating tubers from mefenoxam-treated plants with *P.infestans*, and then re-inoculating the tubers with *P.erythroseptica* at various time intervals to ascertain pink rot development. The results of these studies will be presented as part of a continuing evaluation of the effectiveness of mefenoxam for control of pink rot in Canada.

Session A: Pathogen-host interactions
14:55-15:10

Systemic acquired resistance against *Potato virus Y* in tobacco is salicylate-mediated and ethylene independent

Xianzhou Nie

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Using a severe isolate of *Potato virus Y* strain group N:O ($PVY^{N:O}$) and tobacco plants, interactions between the host and virus were investigated. The systemic development of symptoms in tobacco plants could be divided into three stages after inoculation with the virus: virus incubation stage, rapid symptom-progress stage, and partial recovery and symptom-shifting stage. Treatment of seedlings with salicylic acid (SA) delayed the virus-induced necrosis in stems by one to two days. SA, not aminocyclopropane-1-carboxylic acid (ACC), the precursor of phytohormone ethylene, also significantly suppressed the symptom severity in stems. Further analysis indicated that the accumulation of PVY was retarded by SA at the early stage of infection, and the effects were more profound in stems than leaves. Peroxidase (POX) activity and pathogenesis-related (PR) genes including *PR-1a* and *PR-1b* were enhanced by PVY infection. SA not only increased POX activity in stems and PR genes in stems and leaves of mock-inoculated plants, but also elevated the activity of POX in both leaves and stems and the expression of *PR-1a* in leaves of PVY infected plants. Together, the results suggest that systemic acquired resistance plays a role in suppressing $PVY^{N:O}$ induced symptom development through SA-mediated and ethylene-independent pathway(s). The symptom suppression was correlated with reduced replication/accumulation of virus at the early stage of infection.

Session B: Pathogen detection and disease diagnosis
15:40-15:55

Real-Time PCR assay for the detection of potato viruses in a triplex format

Mathuresh Singh, Rudra P. Singh, and Robert Coffin

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A triplex real-time PCR assay was developed to detect *Potato virus Y* (PVY), *Potato leafroll Virus* (PLRV), *Potato virus S* (PVS) and *Potato virus X* (PVX), in various virus-combinations from greenhouse and field grown dormant tubers. Two different methods of nucleic acid extraction, including 'sodium-sulfite extraction and dot-blot elution' were evaluated to determine one single protocol, which is efficient and equally applicable to all viruses. The dot-blot elution method was found to be rapid, cost effective, used no organic solvents and provided reliable results for simplex and duplex PCR. Several TaqMan probes were designed based on gene sequences available from databases and synthesized by Applied Biosystems with three terminal reporter dyes and one quencher dye. The probes were tested in all possible combinations in duplex and triplex format for their cross reactivity. No cross reactivity was detected in any combination tested for PVY, PLRV, PVS and PVX. Preliminary data on comparison of real-time PCR with conventional PCR indicates that real-time is more sensitive in detecting viruses from field grown dormant tubers, thus enabling testing of tubers for early shipment.

Session B: Pathogen detection and disease diagnosis
15:55-16:10

Viroid RNAs, PCR fragments and plasmid purification simplified by spotting an alkaline extract onto nitrocellulose membrane

R. P. Singh, A. D. Dilworth, M. Singh and K. M. Babcock

Potato Research Centre, 850 Lincoln Road, Fredericton, NB E3B 4Z7, Canada; (M.S and K.M.B) Agricultural Certification Services, 1030 Lincoln Road, Fredericton, NB E3B 8B7, Canada

To facilitate large-scale systematic studies of viroids in ornamental plants, a genus *Pospiviroid*-specific primer pair and simplified protocols for the preparation of nucleic acid and plasmid purification was developed. The method consists of preparing crude extracts in NaOH-EDTA solution and using the supernatant for the tests. The NaOH-EDTA extract can be used at four distinct stages of preparation depending upon the accuracy desired, namely 1) Incubation of extract for 15 min at room temperature and the use of the supernatant for RT-PCR; 2) The supernatant sap can be spotted onto a nitrocellulose membrane without vacuum, and the water-eluted liquid from an individual spot is used for RT-PCR; 3) Centrifugation of the extract and use of the supernatant in RT-PCR; and 4) For quantitative accuracy, spotting the centrifuged supernatant on nitrocellulose using a vacuum device and then using the water-eluted liquid from spots for RT-PCR. Efficiency of detection could range from 60 % in format 1 and 3 to as high as 95-100 % in format 2 and 4. The fourth format can be used to purify an amplified product for DNA cloning and for plasmid purification. The protocols are rapid, inexpensive and applicable to large-scale epidemiological surveys of ornamental plants for the presence of viroids and in plasmid purification. The membranes are easily transported long distances and can be stored at room temperature for several months while retaining the ability to detect viroids by RT-PCR and by infectivity assays.

Session C: Disease management
16:10-16:25

Suppression of potato (*Solanum tuberosum*) early blight (*in vivo*) and germination of *Alternaria* spp. conidia (*in vitro*) with strobilurin fungicides

W. MacDonald, R. D. Peters, R. H. Coffin, and C. Lacroix

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Experimental potato fields were established in New Annan, Prince Edward Island (PEI), to assess the efficacy of strobilurin fungicides (Quadris® and Headline®) to suppress *Alternaria solani*, causal agent of potato early blight. At the end of the growing season, these field trials were rated according to the Horsfall-Barratt scale and an obvious fungicide treatment effect was observed. The incidence and severity of early blight was low in plots treated with strobilurin fungicides compared to untreated plots where disease was more severe. These ratings also revealed differences in disease based on cultivar type and nitrogen availability, although these differences were less marked in comparison to the fungicide treatment. In addition to the foliage assessment, isolates of *A. solani* as well as *Alternaria alternata*, another ubiquitous leaf-spot pathogen, were collected from several PEI potato fields, both experimental and commercial, for subsequent laboratory work. An *in vitro* spore germination assay was used to measure sensitivity of these isolates to azoxystrobin, the active ingredient in Quadris® fungicide. The effective concentration that inhibited spore germination by 50% (EC_{50}) was determined for each isolate. In 2003, EC_{50} values ranged from 0.003-0.014 µg/ml for the *A. solani* isolates tested, while the values for the *A. alternata* isolates ranged from 0.001-0.023 µg/ml. EC_{50} values for the 2004 collection of isolates were similar to the 2003 results with *A. solani* isolates ranging from 0.002-0.022 µg/ml and *A. alternata* isolates ranging from 0.003-0.028 µg/ml. These results suggest that the isolates tested are sensitive to azoxystrobin and no indication of reduced-sensitivity or resistance was observed. This sensitivity is likely due to the limited exposure of these two pathogens (*A. solani* and *A. alternata*) to strobilurin chemistry in Prince Edward Island potato fields.

Session C: Disease management
16:25-16:40

Evaluation of at-planting in-furrow application of Phostrol and Ridomil Gold 480EC for potato pink rot control

Khalil I. Al-Mughrabi, and Rick D. Peters
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Field trials were established in Florenceville, New Brunswick, Canada to evaluate the effect of at-planting in-furrow application of Phostrol™ (mono-and dibasic sodium, potassium and ammonium phosphates) and Ridomil® Gold 480EC (Metalaxyl-M and S isomer) on pink rot control in potatoes (cvs. Shepody and Russet Burbank). Inoculum made from a metalaxyl-m-sensitive isolate of *Phytophthora erythroseptica* from New Brunswick was applied either as a vermiculite slurry in-furrow at planting, or as a zoospore drench in soils adjacent to plants in late August. After harvest, number and weight of tubers showing pink rot symptoms were assessed, and percent of total tuber weight and number composed of diseased tubers was calculated. Ridomil® Gold 480EC applied in-furrow was found to be significantly ($P<0.001$) more effective against pink rot than Phostrol™. The mean weight of diseased tubers as a percentage of total tuber weight was 1.53 in the Ridomil® treatment and 9.55 in the Phostrol™ treatment (similar to the inoculated control). The mean number of diseased tubers as a percentage of total tuber number was 1.71 in the Ridomil® treatment and 10.14 in the Phostrol™ treatment. The late season inoculation yielded significantly ($P<0.001$) more disease (mean percent of 9.98 for weight of diseased tubers and 10.55 for number of diseased tubers) than the in-furrow inoculation (mean percent of 3.32 for weight of diseased tubers and 3.71 for number of diseased tubers). The potato cultivar Shepody was significantly ($P<0.001$) more susceptible to pink rot (mean percent of 9.87 for weight of diseased tubers and 10.56 for number of diseased tubers) than Russet Burbank (mean percent of 3.43 for weight of diseased tubers and 3.70 for number of diseased tubers). Our findings indicate that Ridomil® Gold 480EC applied in-furrow at planting is a viable option for control of pink rot caused by metalaxyl-m-sensitive strains of *P. erythroseptica* in New Brunswick.

Session C: Disease management
16:40-16:55

Biological control of apple replant disease

P. G. Braun, and K. K. Fuller

Atlantic Food and Horticulture Research Centre, Agriculture and Agri-Food Canada, 32 Main St. Kentville, NS B4N 1J5, Canada

Apple (*Malus* × *domestica* Borkh.) replant disease (ARD) is a serious problem throughout the temperate apple growing regions of the world. It is caused by a complex of soil micro-organisms and exacerbated by changes in soil chemistry and physical conditions resulting from long term apple production. Methyl bromide, a broad-spectrum soil fumigant, has been an effective and reliable management tool for this complex disease. However, the Montreal Protocol called for a phase-out of methyl bromide requiring the development of alternative management strategies. While alternative fumigants are available, a non-chemical strategy for disease management would be the most beneficial for both the grower/applicator and the environment. Six rows of old apple trees were removed and the plot divided into a randomized complete block design with four blocks of six treatments. The treatments were, 1) non-treated control, 2) soil fumigation with Telone C-17, 3) deep ripping, 4) deep ripping plus fumigation, 5) deep ripping plus compost and 6) deep ripping plus compost plus fumigation applied prior to planting. Fumigation significantly ($P<.001$) increased trunk cross-sectional area (TCA)(56 vs 69% relative growth) over four years and yields in the first cropping year (48 vs 92 apples/tree) while deep ripping had no effect on TCA (58 vs 59% rg) but significantly ($P<.001$) reduced yield (70 vs 46 a/t). However, deep ripping plus compost significantly ($P=0.01$) increased both TCA and fruit set (59 vs 70% rg and 70 vs 94 a/t, respectively). While deep ripping plus compost was not as effective as fumigation it was significantly better than the control and will fill the available tree space in six years with an acceptable yield potential.

Session C: Disease management
16:55-17:10

Increasing the sustainability of potato production in Atlantic Canada with crop rotation and conservation tillage

R. D. Peters, M. R. Carter, J. B. Sanderson, and A. V. Sturz

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A field trial was established in 1994 at the Harrington Research Farm, Prince Edward Island to assess the feasibility of using conservation tillage practices in combination with crop residue mulches (after the potato harvest) in 2- and 3-year potato rotations. Surface residue cover prior to potato planting increased (to 15-36% cover) with the conservation tillage system in both 2 and 3-year rotations. Marketable tuber yield averaged 4.57 t/ha less for the 2-versus the 3-year rotation. Soils under conservation tillage had significantly higher contents of organic carbon, particulate-C, and microbial carbon and improved soil aggregation compared to the conventional tillage system. The severity of stem and stolon canker and black scurf (*Rhizoctonia solani*) was substantially (P=0.05) reduced in plants grown in 3-year rotations compared to those grown in 2-year rotations. In general, the severity of dry rot, silver scurf and common scab was not significantly influenced by tillage system or rotation length. Following inoculation with *Phytophthora erythroseptica*, plants and tubers from 3-year rotation plots were more resistant to pink rot than those from 2-year rotation plots. The 3-year rotation/conservation tillage system reduced energy costs, maintained a continuum of soil cover near 30 % prior to potato planting (reducing the risk for soil erosion), improved soil organic and physical quality at the soil surface (reducing the risk of moisture stress), and reduced the severity of diseases caused by soil-borne pathogens.

Session C: Disease management
17:10-17:25

Re-assessment of the presence of *Pospiviroid* species in floral parts using RT-PCR and infectivity assays

R. P. Singh

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Potato spindle tuber viroid (PSTVd) is transmitted through seed and has been recovered from the floral parts of several host plants over 40 years. However, a recent study (*Zhu et al. 2001: Virology 279, 69-77*) using *Agrobacterium*-mediated inoculation and *in situ* hybridization has shown that PSTVd is present in sepals, but is absent in the petals, stamens, and ovary of infected tomato plants. In our earlier studies, the presence of PSTVd in floral parts was determined by infectivity and polyacrylamide gel electrophoresis assays. In this study, the presence of PSTVd and other *Pospiviroid* species in floral parts of tomato and other host species was studied using the highly sensitive reverse-transcription polymerase chain reaction (RT-PCR) along with infectivity. This re-assessment showed that PSTVd was present in all the floral parts of tomato. Moreover, floral organ-extracts containing the infectious viroid caused characteristic PSTVd symptoms in tomato seedlings. Additionally *Tomato chlorotic dwarf viroid* (TCDVd) a non seed-transmissible viroid and PSTVd, were both detected in the floral parts of *Nicotiana glutinosa*. Both viroids caused characteristic colour-break symptoms in the petals. Pospiviroids isolated from ornamental plants (*Verbena* and *Impatiens*) with two different types of petals were also detected in floral parts of the infected plants. This study reconfirms that the pospiviroids can invade all floral parts of host plants.

Appendix

Participants of CPS Maritime Region Meeting 2005

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