OPMC

Ontario Pest Management Conference 2021

18th Annual

Pandemic Shift – The Changing Path of Pest Management

November 2, 2021

Virtual Conference (Zoom)

Website: www.opmconference.ca

OPMC Logo and Banner Design by Doug Schaefer

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OPMC Organizing Committee

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Roselyne Labbé, Agriculture and Agri-Food Canada
Robert Nurse, Agriculture and Agri-Food Canada
Julie Schipper, Valent BioSciences
Cynthia Scott-Dupree, School of Environmental Sciences, University of Guelph
Sean Westerveld, Ontario Ministry of Agriculture, Food and Rural Affairs

AGENDA

8:45 a.m – 8:55 a.m **Zoom Session opens for log in**

MORNING SESSION

9:00 am **Welcome: Kristen Obeid**, Chair, Ontario Pest Management Conference
Opening Remarks and Introduction of Online Format, Overview of General Posters

9:05 am Plenary Speaker:

Dr. Sylvain Charlebois

Professor of Food Disribution and Policy and Director, Agri-Food Analytics Lab
Dalhousie University

"Surviving the pandemic: Things about risks we never learned in school"

9:40 am Occurrence and host range of the brown marmorated stink bug parasitoid *Trissolcus japonicus* in Ontario, Canada. **Caitlin MacDonald**, T. Gariepy, H. Fraser and C. Scott-Dupree. (Student Competition)

9:55 am Interactions of 4-hydroxyphenylpyruvate dioxygenase (HPPD)-inhibiting and reactive oxygen species (ROS)-generating herbicides for the control of annual weed species in corn. **John Fluttert**, M. Galla, D. Hooker, D. Robinson and P. Sikkema. (Student Competition)

10:10 am The effect of plant age on the susceptibility of American ginseng (*Panax quinquefolius* L.) to replant disease. **Amy Fang Shi** and S. Westerveld. (Student Competition)

10:25 am The sterile insect technique as a novel tool for control of pepper weevil (*Anthonomus eugenii* Cano) in greenhouse and field pepper crops. **Jacob Basso**, R. Labbé and C. Scott-Dupree. (Student Competition)

10:40 am – 11:00 am Bio Break

11:00 am Laudis. **Lauren Benoit**, Bayer. (Industry Speaker)

11:10 am Comparative efficacy of biocontrol agents for managing western flower thrips (*Frankliniella occidentalis*) and onion thrips (*Thrips tabaci*) in greenhouse ornamentals. **Ashley Summerfield**, R. Buitenhuis, S. Jandricic and C. Scott-Dupree. (Student Competition)

11:25 am Investigation of management practices to optimize cover crop-based weed mitigation in Canadian sweet corn production. **Hayley Brackenridge,** J. Bae, M.J. Simard, F. Tardif, K. Bosveld and R. Nurse. (Student Competition)

11:40 am Head smut (*Tilletia maclaganii*) on switchgrass (*Panicum virgatum*). **Clyde Yan,** E. Lyons, M.R. McDonald, M. Thimmanagari, S. Kenaley and K. Jordan. (Student Competition)

11:55 am Evaluating the parasitoid *Jaliscoa hunteri* as a biological control agent for the pepper weevil, *Anthonomus eugenii*, on Canadian greenhouse pepper crops. **Serena Leo,** C. Scott-Dupree and R. Labbé. (Student Competition)

12:10 pm What is the better tankmix partner, saflufenacil or metribuzin, with dicamba, 2,4-D ester, halauxifen-methyl or pyraflufen-ethyl/2,4-D, applied preplant, for glyphosate-resistant Canada fleabane control in soybean? **Meghan Dilliott**, D. Hooker, D. Robinson and P. Sikkema. (Student Competition)

12:25 pm - 1:00 pm Lunch Break

AFTERNOON SESSION

1:00 pm Student Poster Competition – 5 minute pre-recorded presentations and general audience questions. Part 1. **Emily Glasgow, Marlee-Ann Lyle, Shauna Chesney, Jerry Akanwari**. (Student Poster Competition)

1:35 pm Excalia – A new fungicide for controlling scab and powdery mildew in apples. **Julie Schipper**, Valent Canada. (Industry Speaker)

1:45 pm Plenary Speaker:

Dr. Andrew Gadsden
Associate Professor, School of Engineering
University of Guelph

"Smart systems in agriculture: Future trends and labour impacts"

2:20 pm Student Poster Competition – 5 minute pre-recorded presentations and general audience questions. Part 2. **Abigail Wiesner, Joel Goodwin, Andrew LaFlair, Emily McFaul, Harguun Dogra.** (Student Poster Competition)

2:50 pm **Presentation of Student Competition Award Winners – Julie Schipper**, CropLife Canada
Closing Remarks and Adjourn – Kristen Obeid, Chair, OPMC

PLENARY SPEAKER BIOGRAPHIES

Dr. Sylvain Charlebois - Professor of Food Disribution and Policy and Director, Agri-Food Analytics Lab, Dalhousie University

Dr. Sylvain Charlebois is a Professor in food distribution and policy in the Faculties of Management and Agriculture and the Senior Director of the Agri-food Analytics Lab at Dalhousie University in Halifax. He is the former Dean of the Faculty of Management at Dalhousie. Before joining Dalhousie, he was affiliated with the University of Guelph's Arrell Food Institute, which he co-founded. At the University of Guelph, he was the Associate Dean of Research for the College of Business and Economics. Known as "The Food Professor", his current research interest lies in the broad area of food distribution, security and safety. He is one of the world's most cited scholars in food supply chain management, food value chains and traceability. He has authored five books on global food systems, his most recent one published in 2017 by Wiley-Blackwell entitled "Food Safety, Risk Intelligence and Benchmarking". He has published over 500 peer-reviewed journal articles in several academic publications and his research has been featured in several newspapers and media groups, including The Lancet, The Economist, the New York Times, the Boston Globe, the Wall Street Journal, Washington Post, BBC, NBC, ABC, Fox News, Foreign Affairs, the Globe & Mail, the National Post and the Toronto Star. Dr. Charlebois sits on a few company boards, and supports many organizations as a special advisor, including some publicly traded companies. Dr. Charlebois is also a member of the Scientific Council of the Business Scientific Institute in Luxemburg. Dr. Charlebois is a member of the Global Food Traceability Centre's Advisory Board based in Washington DC, and a member of the National Scientific Committee of the Canadian Food Inspection Agency (CFIA) in Ottawa.

Dr. Andrew Gadsden, Associate Professor – School of Engineering, University of Guelph

Andrew completed his Bachelors in Mechanical Engineering and Management (Business) at McMaster University. He completed his PhD in Mechanical Engineering at McMaster in the area of estimation theory with applications to mechatronics and aerospace systems. Andrew worked as a postdoctoral researcher at the Centre for Mechatronics and Hybrid Technology (Hamilton, Ont.). He also worked as a Project Manager in the pharmaceutical industry (Apotex Inc.) for about three years. Before joining the University of Guelph, he was an Assistant Professor in the Department of Mechanical Engineering at the University of Maryland, Baltimore County. Andrew worked with colleagues in NASA, the US Army Research Laboratory (ARL), US Department of Agriculture (USDA), National Institute of Standards and Technology (NIST), and the Maryland Department of the Environment (MDE). He is an elected Fellow of ASME, is a Senior Member of IEEE, and is a Professional Engineer of Ontario. Andrew earned the 2019/2020 University Research Excellence Award for the College of Engineering and Physical Sciences based on his research activities at the University of Guelph. He is also a 2019 SPIE Rising Researcher award winner based on his work in intelligent estimation theory, and a 2018 Ontario Early Researcher award (ERA) winner based on his work in intelligent condition monitoring strategies. He was also awarded the 2019 University of Guelph Faculty Association (UGFA) Distinguished Professor Award for Excellence in Teaching in the College of Engineering and Physical Sciences.

–CROPLIFE STUDENT COMPETITION–

Student Oral Presentations:

OP-1 Occurrence and host range of the brown marmorated stink bug parasitoid *Trissolcus japonicus* in Ontario, Canada. **Caitlin MacDonald**, T. Gariepy, H. Fraser and C. Scott-Dupree. **(Presentation Time: 9:40-9:55 am)**

OP-2 Interactions of 4-hydroxyphenylpyruvate dioxygenase (HPPD)-inhibiting and reactive oxygen species (ROS)-generating herbicides for the control of annual weed species in corn. **John Fluttert**, M. Galla, D. Hooker, D. Robinson and P. Sikkema. **(Presentation Time: 9:55-10:10 am)**

OP-3 The effect of plant age on the susceptibility of American ginseng (*Panax quinquefolius* L.) to replant disease. **Amy Fang Shi** and S. Westerveld. **(Presentation Time: 10:10-10:25 am)**

OP-4 The sterile insect technique as a novel tool for control of pepper weevil (*Anthonomus eugenii* Cano) in greenhouse and field pepper crops. **Jacob Basso**, R. Labbé and C. Scott-Dupree. **(Presentation Time: 10:25-10:40 am)**

OP-5 Comparative efficacy of biocontrol agents for managing western flower thrips (*Frankliniella occidentalis*) and onion thrips (*Thrips tabaci*) in greenhouse ornamentals. **Ashley Summerfield**, R. Buitenhuis, S. Jandricic and C. Scott-Dupree. **(Presentation Time: 11:10-11:25 am)**

OP-6 Investigation of management practices to optimize cover crop-based weed mitigation in Canadian sweet corn production. **Hayley Brackenridge,** J. Bae, M.J. Simard, F. Tardif, K. Bosveld and R. Nurse. **(Presentation Time: 11:25-11:40 am)**

OP-7 Head smut (*Tilletia maclaganii*) on switchgrass (*Panicum virgatum*). **Clyde Yan,** E. Lyons, M.R. McDonald, M. Thimmanagari and S. Kenaley. **(Presentation Time: 11:40-11:55 am)**

OP-8 Evaluating the parasitoid *Jaliscoa hunteri* as a biological control agent for the pepper weevil, *Anthonomus eugenii*, on Canadian greenhouse pepper crops. **Serena Leo,** C. Scott-Dupree and R. Labbé. **(Presentation Time: 11:55 am-12:10 pm)**

OP-9 What is the better tankmix partner, saflufenacil or metribuzin, with dicamba, 2,4-D ester, halauxifen-methyl or pyraflufen-ethyl/2,4-D, applied preplant, for glyphosate-resistant Canada fleabane control in soybean? Meghan Dilliott, D. Hooker, D. Robinson and P. Sikkema. **(Presentation Time: 12:10-12:25 pm)**

Judges: Sean Westerveld - OMAFRA (Judging Coordinator)

1. Andrew Wylie – OMAFRA
2. John Purdy – Abacus Consulting Services Limited
3. Hannah Fraser – OMAFRA
4. Scott Hodgins – Cohort Wholesale

-Student Poster Presentations –

Graduate Student Competition:

GP-1 A genetic analysis of the distribution of pheromone races of the European corn borer, *Ostrinia nubilalis* (Hübner), in Canada. **Emily Glasgow**, R. Hallett and J. Smith. **(Time of judging 9:45-9:50 am, General Audience Q & A 1:00-1:35 pm**).

GP-2 Molecular detection of cyclamen mite (*Phytonemus pallidus*) in strawberry**.** **Marlee-Ann Lyle**, A. Naaum, A. Gradish, J. Renkema and R. Hallett. **(Time of judging 9:55 - 10:00 am, General Audience Q & A 1:00-1:35 pm)**

GP-3 Soil treatments to suppress clubroot. **Shauna Chesney**, B. Gossen and M.R. McDonald. **(Time of judging 10:05-10:10 am, General Audience Q & A 1:00-1:35 pm)**

GP-4 WITHDRAWN

GP-5 Understanding efficacy of a novel nematicide for management of northern root knot nematode. **Jerry Akanwari** and T. Sultana. **(Time of judging 10:25-10:30 am, General Audience Q & A 1:00-1:35 pm)**

GP-6 Suitability of *Euonymus* spp. for box tree moth (*Cydalima perspectalis*) survival and development. **Abigail Wiesner,** J. Llewellyn, S. Smith and C. Scott-Dupree. **(Time of judging 10:30 –10:35 am, General Audience Q & A 2:20-2:50 pm)**

GP-7 Characterizing the active space of pheromone traps for spruce budworm and *Lymantria dispar*. **Joel T.L. Goodwin,** S. Smith and J. Allison. **(Time of judging 10:55-11:00 am, General Audience Q & A 2:20-2:50 pm)**

GP-8 Functional response and predatory capacity of a native generalist biological control agent, *Nabis americoferus* Carayon (Hemiptera: Nabidae), towards lepidopteran pests. **Andrew LaFlair,** S Vanlaerhoven and R. Labbe. **(Time of judging 11:05 -11:10 am, General Audience Q & A 2:20-2:50 pm)**

Undergraduate Student Competition:

UP-1 Resistance of *Stemphylium vesicarium* in onions to azoxystrobin and fluopyram fungicides. **Emily McFaul** and M.R. McDonald. **(Time of judging 11:15-11:20 am, General Audience Q & A 2:20-2:50 pm)**

UP-2 *Bacillus amyloliquefaciens* based biocontrol formulations suppressed fusarium head blight and associated vomitoxin production in wheat under field conditions. **Harguun Dogra,** J. Hoage, E. Mabed, N. Clark, J. Chen, S Kandasamy, S. Saldias, S. Ali and G. Lazarovits. **(Time of judging 11:20 -11:25 am, General Audience Q & A 2:20-2:50 pm)**

Students should be present in the waiting room 5 minutes prior to their scheduled judging time, as well as the scheduled playback of their group of pre-recorded presentations and be prepared to answer questions from the OPMC audience (not judged) at the end

Judges: Sean Westerveld – OMAFRA (Judging Coordinator)

1. Travis Cranmer - OMAFRA
2. Ashley Dickson – Syngenta Canada
3. Ian Scott – AAFC
4. Amanda Tracey – OMAFRA

-REGULAR POSTER PRESENTATIONS-

RP-1 The Holland/Bradford Marsh Integrated Pest Management Program highlights from the 2021 season. **Tyler Blauel** and M.R. McDonald**.**

RP-2 Evaluation of a quantitative polymerase chain reaction assay for detection of *Ilyonectria mors-panacis* in soil. **Komathy Prapagar,** S. Westerveld, A. Shi, M.R. McDonald and M. Kalischuk.

RP-3 Exploring native predatory hemipteran species for use as biological controls in Canadian vegetable production. **Paige Desloges Baril**, L. Des Marteaux and S. VanLaerhoven.

RP-4 Insect pests & natural enemies associated with outdoor cannabis production in Canada. **Lillian Auty,** R. Vanstone, J. Lemay and C. Scott-Dupree.

RP-5 The need for an improved disease forecasting model for Stemphylium leaf blight of onion. **Michael Kooy,** B. Gossen and M.R. McDonald.

RP-6 The impact of insecticide application timing and infestation load in the management of western bean cutworm, *Striacosta albicosta*, in edible dry beans. **Josée Kelly.**

RP-7 Breeding program for *Varroa* mite resistance in Ontario honey bee populations. **Alvaro De la Mora,** B. Emsen, N. Morfin, P. Kelly, D. Borges, L. Eccles, P. Goodwin and E. Guzman-Novoa.

PDFs of all Student Competition and regular posters will be made available exclusively to conference attendees at a secure website link provided to registrants prior to the conference.

ORAL PRESENTATION ABSTRACTS
MORNING SESSION

PLENARY 1:

Surviving the pandemic: Things about risks we never learned in school

Sylvain Charlebois
Dalhousie University, Halifax, NS

The pandemic got everyone to think differently about risks, businesses, governments, consumers, regulators, everyone. The way we manage risks as a society will likely have changed forever. As we befriend the virus, insurance premiums are already going up. The way we operate the entire supply chains, from farm to fork has changed, likely forever. One thing we have all learned is that striking the right balance between managing factual risks with limited science and coping with fear is not trivial. Charlebois will examine what most call "The New Normal" and COVID-19's lasting impact on food regulations and the food industry as a whole.

CROPLIFE STUDENT COMPETITION (OP-1):

Occurrence and host range of the brown marmorated stink bug parasitoid *Trissolcus japonicus* in Ontario, Canada

Caitlin MacDonald[1,2], Tara Gariepy[2], Hannah Fraser[3] and Cynthia Scott-Dupree[1]
[1]School of Environmental Sciences, University of Guelph, Guelph, ON
[2]Agriculture and Agri-Food Canada, London, ON
[3]Ontario Ministry of Agriculture, Food & Rural Affairs, Guelph, ON

Trissolcus japonicus (Ashmead) (Hymenoptera: Scelionidae), is an Asian egg parasitoid of *Halyomorpha halys* (Stål) (Hemiptera: Pentatomidae), the brown marmorated stink bug (BMSB). Brown marmorated stink bug is a serious invasive agricultural pest in Europe and North America, and insecticides appear to be of limited efficacy. *Trissolcus japonicus* is being considered as a classical biological control agent in many regions where BMSB has established. Given the recent discovery of adventive populations of *T. japonicus* outside of its native range, surveys to determine the establishment and spread of adventive populations in southern Ontario are being conducted. Data collected in the summers of 2019 and 2020 demonstrated that *T. japonicus* populations continue to persist in London, Ontario, but have not yet been found in other areas of southern Ontario. Research is being conducted to investigate *T. japonicus'* physiological host range with 9 non-target stink bugs, and one squash bug, native to Ontario. Results suggest 6 of these stink bugs are within *T. japonicus'* physiological host range. Choice test results such that *Podisus maculiventris, Thyanta custator accerra,* and *Chinavia hilaris* may be less likely to be attacked in the field. Further research is required to determine what might occur in the field.

CROPLIFE STUDENT COMPETITION (OP-2):

Interactions of 4-hydroxyphenylpyruvate dioxygenase (HPPD)-inhibiting and reactive oxygen species (ROS)-generating herbicides for the control of annual weed species in corn

John Fluttert[1], Mariano Galla[2], David Hooker[1], Darren Robinson[1], and Peter Sikkema[1]
[1]Department of Plant Agriculture, University of Guelph, Ridgetown, ON
[2]ISK Biosciences Inc., Concord, OH

The interaction between 4-hydroxyphenylpyruvate dioxygenase (HPPD)-inhibiting herbicides and photosystem II (PSII)-inhibiting herbicides has been documented. HPPD-inhibitors reduce the ability of a plant to quench reactive oxygen species (ROS) while PSII-inhibitors upregulate the production of ROS which can ultimately cause cell death by lipid peroxidation. The interrelated modes of action of

HPPD- and PSII-inhibitors has been credited for the synergistic interaction between the two herbicides for the control of several weed species; however, additive interactions between the herbicides are also common. Recent research has identified that ROS generation and subsequent lipid peroxidation is the cause of cell death by the glutamine synthetase-inhibitor, glufosinate. Therefore, a basis for synergy exists between glufosinate and HPPD-inhibitors; however, the interaction has not been intensively studied. Four field trials were conducted in southwestern Ontario in 2020 and 2021 to determine the interaction between HPPD-inhibiting (mesotrione and tolpyralate) and ROS-generating (atrazine, bromoxynil, bentazon, and glufosinate) herbicides for the control of several annual weed species in *Zea mays* L. Tank-mixes of HPPD-inhibitors + ROS-generators were synergistic for the control of *Ambrosia artemisiifolia* L. except for tolpyralate + glufosinate which was antagonistic 8 weeks after application (WAA). Tolpyralate + glufosinate was also antagonistic for the control of *Setaria* spp. 8 WAA. For the control of *Chenopodium album* L. 8 WAA, mesotrione + atrazine, bromoxynil, or glufosinate and tolpyralate + bromoxynil or bentazon were synergistic. All herbicide tank-mixes were additive for the control of *Sinapis arvensis* L. 8 WAA except for the synergistic tank-mixes of tolpyralate + atrazine or bromoxynil.

CROPLIFE STUDENT COMPETITION (OP-3):

The effect of plant age on the susceptibility of American ginseng (*Panax quinquefolius* L.) to replant disease

Amy Fang Shi[1] and Sean Westerveld[2]
[1]School of Environmental Sciences, University of Guelph, Simcoe, ON
[2]Ontario Ministry of Agriculture, Food and Rural Affairs, Simcoe, ON

Ginseng replant disease (GRD) prevents successive ginseng cultivation on the same land without considerable crop losses. Although the cause of GRD is not fully understood, a fungal pathogen *Ilyonectria mors-panacis* (IMP) is known to be involved. The symptoms of GRD are often not observed until plants became older in replanted gardens. To understand whether this is due to progressive development of the disease over time or if older plants are more susceptible, two field trials were conducted at a replanted site where ginseng was harvested 10 years earlier. Three and four ages of ginseng were manually transplanted from newly planted gardens to the replant garden in fall 2019 and in fall 2020, respectively. The trial was arranged in a randomized complete block design with four replications. Foliar symptoms caused by IMP started to show on older plants in late July, nine months after transplanting. A root assessment was conducted to analyze disease incidence and severity in late August. The Disease Severity Index (DSI) increased with increasing age in both trials. When comparing the same three ages in each trial, the linear regression model had R squared value of 0.9875 and 0.9834, respectively. The results suggest that older plants are more susceptible to GRD. *Ilyonectria mors-panacis* was present in roots of all ages but younger plants displayed fewer symptoms. Therefore, it is important to manage GRD early in a replant garden even though obvious disease symptoms may not be present until the second year.

CROPLIFE STUDENT COMPETITION (OP-4):

The sterile insect technique as a novel tool for control of pepper weevil (*Anthonomus eugenii* Cano) in greenhouse and field pepper crops

Jacob Basso[1], Roselyne Labbé[2] and Cynthia Scott-Dupree[1]
[1]School of Environmental Sciences, University of Guelph, Guelph, ON
[2]Agriculture and Agri-Food Canada, Harrow, ON

The pepper weevil (PW; *Anthonomus eugenii* Cano) is a significant pest of pepper crops in North America, with occasional outbreaks occurring internationally. Yield losses can reach 50-100% in severe infestations, resulting in millions of dollars in economic damage annually. Larvae develop entirely within pepper buds and fruit causing premature fruit abortion. This cryptic lifestyle means that insecticide sprays are generally ineffective for managing PW, and insecticide resistance development is a concern. Furthermore, biological controls for PW are not yet commercialized. The sterile insect technique (SIT) is a novel approach to PW management, though it is an established method used to control a diversity of pests in Canada and worldwide. This foundational study focuses on producing high-quality sterile male insects for a PW-SIT system. Our results show that 100% of late-instar PW pupae of both sexes irradiated at 110Gy of gamma-radiation failed to produce offspring. The longevity of irradiated weevils was shorter than unirradiated weevils, though it may be sufficiently long for a viable PW-SIT system. Together with ongoing research assessing the quality of sterilized male PW including their flight ability, sperm production and transfer, mating behaviour, and competitiveness, this study lays the groundwork for development of a sustainable new tool for sustainable PW suppression, both in field and greenhouse pepper crops.

INDUSTRY PRESENTATION:

Laudis

Lauren Benoit
Bayer, Perth South, ON

Laudis herbicide, containing the active ingredient tembotrione with safener isoaxdifen, is a post-applied group 27 herbicide for corn in Eastern Canada. Tembotrione is a HPPD-inhibiting herbicide in the triktone family. Laudis has high levels of activity on broadleaf weeds and suppression of some grass species. Tank-mix options: atrazine, bromoxynil, glyphosate, and dicamba, enhance both initial burndown and residual activity. 98% control of multiple herbicide resistant waterhemp can be achieved with Laudis + atrazine + adjuvants.

CROPLIFE STUDENT COMPETITION (OP-5):

Comparative efficacy of biocontrol agents for managing western flower thrips (*Frankliniella occidentalis*) and onion thrips (*Thrips tabaci*) in greenhouse ornamentals

Ashley Summerfield[1,2], Rose Buitenhuis[2], Sarah Jandricic[3] and Cynthia Scott-Dupree[1]
[1]School of Environmental Science, University of Guelph, Guelph, ON
[2] Agriculture and Agri-Food Canada, Vineland, ON
[3]Ontario Ministry of Agriculture, Food and Rural Affairs, Vineland, ON

Integrated pest management (IPM) of thrips in horticulture greenhouses have been studied primarily with the management of western flower thrips (*Frankliniella occidentalis,* WFT) in mind. Although WFT are still the primary thrips pest in greenhouse ornamentals, recent studies have confirmed that horticulture greenhouses are often inhabited by multi-species thrips communities. Onion thrips (*Thrips tabaci,* OT) is the second most common thrips species, making up approximately one third of thrips found in floriculture greenhouses in the Niagara region of Canada. While biocontrol based IPM programs have been managing WFT successfully, outbreaks of OT are occurring more frequently leading to increases in visible feeding damage and crop losses. In order to improve the success of biocontrol based thrips IPM for both thrips species, we must determine which components of this IPM program do not work as well for OT compared to WFT, and identify how to make up for those deficiencies. A series of laboratory and greenhouse experiments were conducted to compare the efficacy of commonly used thrips predators (*Amblyseiulus swirskii, Neoseiulus cucumeris, A. degenerans, Amblydromalus limonicus, Orius insidiosus*), entomopathogenic fungi (*Beauveria bassiana*), and entomopathogenic nematodes (*Steinernema feltiae, S. carpocapsae*) against WFT, OT and mixed thrips populations. The results are presented and recommendations for improving the success of biocontrol based IPM programs are discussed.

CROPLIFE STUDENT COMPETITION (OP-6):

Investigation of management practices to optimize cover crop-based weed mitigation in Canadian sweet corn production

Hayley Brackenridge[1], Jichul Bae[2], Marie-Josée Simard[3], François Tardif[1], Kerry Bosveld[4] and Robert E. Nurse[4]

[1]Department of Plant Agriculture, University of Guelph, Guelph, ON
[2]Agriculture and Agri-Food Canada, Agassiz, BC
[3] Agriculture and Agri-Food Canada, St. Jean-sur-Richelieu, QC
[4] Agriculture and Agri-Food Canada, Harrow, ON

Fall sown cereal rye (*Secale cereal* L.) has gained popularity as a cover crop due to its weed-suppressive capabilities. When mechanically terminated with a roller-crimper, this method of weed control makes an inexpensive enhancement to an integrative weed management program. Research has shown that early milk, occurring in mid-June, is the optimal stage for cereal rye termination via roller-crimper. However, roller-crimping at this timing would cause significant delays in cash crop planting, potentially compromising yields. Therefore, the objective of this research was to identify an earlier maturing cereal rye cultivar. Two cereal rye cultivars (early vs. standard maturity) were compared at three seeding rates (150, 300, and 600 seeds m^{-2}) for their effect on rye biomass and weed control. The trial was conducted at Agassiz, BC, Harrow, ON, and St. Jean-sur-Richelieu, QC in 2019 and 2021 and at Harrow and St. Jean-sur-Richelieu in 2020. Results thus far suggest that the early maturing cereal rye cultivar reaches early milk two to seven days earlier than the standard cultivar at Agassiz and Harrow. This suggests that earlier roller-crimping may be possible at these locations. Additionally, rye biomass was weakly correlated to weed control eight weeks after crimping, however, the strength of this relationship varied among locations and years. In Harrow and St. Jean-sur-Richelieu, both cultivars controlled weeds better when sown at 600 seeds m^{-2} than 150 seeds m^{-2}. These findings emphasize the complexity of roller-crimping cereal rye for weed mitigation and the importance of multi-site-year studies to draw regionally specific conclusions.

CROPLIFE STUDENT COMPETITION (OP-7):

Head smut (*Tilletia maclaganii*) on switchgrass (*Panicum virgatum*)

Clyde Yan[1], Eric Lyons[1], Mary Ruth McDonald[1], Mahendra Thimmanagari[2], Shawn Kenaley[3] and Katerina Jordan[1]

[1]Department of Plant Agriculture, University of Guelph, Guelph, ON
[2]Ontario Ministry of Agriculture, Food and Rural Affairs, Guelph, ON
[3]Dept. of Environmental Conservation and Horticulture, Finger Lakes Community College, Canandaigua, NY

Switchgrass (*Panicum virgatum* L.) is a model biomass crop due to its high yield. Head smut is caused by the fungal pathogen *Tilletia maclaganii* (Berk.) Clint. and poses a substantial threat to switchgrass production. Project objectives involve conducting a field survey to determine smut incidence in Ontario fields, examining the susceptibility of switchgrass cultivars to head smut, and comparing the growth and biomass yield of switchgrass cultivars. The field survey was conducted in 15 Ontario switchgrass fields. At each field, 100 tillers were examined for head smut at 6 sampling points to determine the smut incidence. Smut incidence varied from 0% to >80% and older fields (>5 years) are observed to have higher smut incidence than newer fields. The cultivar resistance trials, consisting of 9 switchgrass cultivars and 1 species of big bluestem, were inoculated with *T. maclaganii* and examined for disease symptoms. Head smut was found on each switchgrass cultivar at least once in 6 replicates, with Cave-in-Rock and RC Tecumseh I having the most infected plants. Fields at the Elora and Simcoe research stations were planted with 9 switchgrass cultivars and one species of big bluestem. Height, leaf width and biomass yield data were collected from each field. No significant difference was observed for biomass yield and height measurement between the cultivars. Leaf width difference was observed between the cultivars at the Elora field. There are still a lot of unknowns regarding this disease and more research is needed to understand and determine management strategies for head smut.

CROPLIFE STUDENT COMPETITION (OP-8):

Evaluating the parasitoid *Jaliscoa hunteri* as a biological control agent for the pepper weevil, *Anthonomus eugenii,* on Canadian greenhouse pepper crops

Serena Leo[1,2], Cynthia Scott-Dupree[2] and Roselyne Labbé[1]
[1]Agriculture and Agri-Food Canada, Harrow, ON
[2]School of Environmental Sciences, University of Guelph, Guelph, ON

The parasitoid wasp *Jaliscoa hunteri* Crawford, is a natural enemy of the pepper weevil (PW) *Anthonomus eugenii* Cano with potential value as a biological control agent on Canadian pepper crops. Native to Mexico but also recorded in Canada, the wasp attacks the hidden larval instars of PW, which are otherwise protected within the pepper fruit. Applying *J. hunteri* for PW biological control could revolutionize how this pest is managed. In our study, we studied the pest suppression potential of *J. hunteri* by releasing wasps onto infested ornamental pepper plants, which significantly reduced adult PW emergence compared to untreated plants. The effect was greatest when the exposure period was longer (7 vs 4 days), and when released to control 3rd larval PW instars. This compliments previous trials in commercial greenhouse pepper that showed that *J. hunteri* releases onto PW infested crops reduced the incidence of PW infestation. Finally, our study of the searching behavior of the wasp demonstrated that mated adult females orient themselves towards infested over uninfested host fruit in Y-tube assays. Together, these results deepen our understanding of *J. hunteri* and its considerable ability to reduce PW emergence and support the development of this species as a biological control agent in Canada.

CROPLIFE STUDENT COMPETITION (OP-9):

What is the better tankmix partner, saflufenacil or metribuzin, with dicamba, 2,4-D ester, halauxifen-methyl or pyraflufen-ethyl/2,4-D, applied preplant, for glyphosate-resistant Canada fleabane control in soybean?

Meghan Dilliott, David Hooker, Darren Robinson and Peter Sikkema
Department of Plant Agriculture, University of Guelph, Ridgetown, ON

Canada fleabane (*Erigeron canadensis* L.) is a facultative winter annual native to North America. Repeated applications of glyphosate have resulted in the rapid evolution of glyphosate-resistant (GR) Canada fleabane. GR Canada fleabane interference can reduce soybean yield up to 93%. Glyphosate plus dicamba, 2,4-D ester, halauxifen-methyl or pyraflufen-ethyl/2,4-D applied preplant (PP) provide variable GR Canada fleabane control in soybean. The objective of this study was to determine if the addition of saflufenacil or metribuzin to glyphosate plus dicamba, 2,4-D ester, halauxifen-methyl or pyraflufen-ethyl/2,4-D will improve the level and consistency of GR Canada fleabane control. Four field trials were conducted over a two-year period (2020, 2021) in commercial fields with confirmed GR Canada fleabane populations. Glyphosate plus dicamba, 2,4-D ester, halauxifen-methyl or pyraflufen-ethyl/2,4-D controlled GR Canada fleabane 96, 77, 71 and 52%, respectively 8 weeks after application (WAA). The addition of saflufenacil or metribuzin to glyphosate plus dicamba or 2,4-D ester did not improve GR Canada fleabane control 8 WAA. The addition of saflufenacil to glyphosate plus halauxifen-methyl or pyraflufen-ethyl/2,4-D improved GR Canada fleabane control 27 and 47%, respectively 8 WAA. The addition of metribuzin to glyphosate plus halauxifen-methyl or pyraflufen-ethyl/2,4-D improved control 25 and 37%, respectively 8 WAA. The consistency of GR Canada fleabane control was improved from the addition of saflufenacil or metribuzin to all tankmix partners. Synergism was observed when metribuzin was added to glyphosate plus halauxifen-methyl and when saflufenacil or metribuzin were added to glyphosate plus pyraflufen-ethyl/2,4-D 8 WAA; interactions between the other tankmixtures were mostly additive.

AFTERNOON SESSION

STUDENT POSTER COMPETITION:

Student Poster Competition – 5 minute pre-recorded presentations and general audience questions, Part 1

Emily Glasgow, Marlee-Ann Lyle, Shauna Chesney and Jerry Akanwari

Pre-recorded overviews for the general OPMC audience of student posters by the first four graduate student competitors (GP-1 through GP-5). Abstracts for these presentations can be found in the poster section below, and posters can be viewed on the OPMC website at the link provided to registrants. Audience members will have the opportunity to ask questions of the poster authors after the presentations.

INDUSTRY PRESENTATION:

Excalia – A new fungicide for controlling scab and powdery mildew in apples

Julie Schipper
Valent Canada, Guelph, ON

Excalia features a new succinate dehydrogenase inhibitor (FRAC 7) active ingredient, INDIFLIN® (the trademark name for inpyrfluxam), which offers fast-acting, highly systemic movement into the plant tissue. This allows the product to interfere with spore germination and mycelial growth for intrinsic potency against apple scab and powdery mildew.

PLENARY 2:

Smart systems in agriculture: Future trends and labour impacts

Andrew Gadsden
School of Engineering, University of Guelph, Guelph, ON

Smart systems are found everywhere in our increasingly automated and interconnected world—from self-driving vehicles to automated agricultural systems. Smart systems research is highly interdisciplinary, and incorporates elements from mechanical, electrical, computer, and software engineering. At its core, smart systems typically contain elements of perception, control, knowledge, and communication. Perception allows the system to observe its environment (e.g., sensors), and control allows the system to manipulate its surroundings (e.g., actuators). Smart systems knowledge base comes in the form of input-output models typically developed by machine learning or expert systems, and allows for the system to complete a goal or objective. Finally, communication allows a smart system to provide feedback to a user or interact with other systems (e.g., networking, internet of things). In Canada, research and development in smart systems has grown significantly in the last decade and offers positive impacts on our society, including manufacturing applications, city planning, healthcare, and space exploration. Driving forces for the adoption of smart systems in our society include the reduction of sensor and component costs, increased automation in daily life, and the increased interconnectivity of devices and systems. These types of systems will have a significant impact on the agricultural industry. From accurately predicting crop yields to automatically detecting pests, smart systems will have a positive impact on the entire food supply and chain. In this talk, future trends and applications for smart systems in agriculture will be considered and its impact on the labour market will be discussed. Current research underway at the University of Guelph in the area of predicting apple yields in an orchard will be summarized as an example of smart systems in agriculture.

STUDENT POSTER COMPETITION:

Student Poster Competition – 5 minute pre-recorded presentations and general audience questions. Part 2

Abigail Wiesner, Joel Goodwin, Andrew LaFlair, Emily McFaul, Harguun Dogra

Pre-recorded overviews for the general OPMC audience of student posters by the remaining graduate student competitors and the undergraduate competitors (GP-6 through GP-8, U1 and U2). Abstracts for these presentations can be found in the poster section below, and posters can be viewed on the OPMC website at the link provided to registrants. Audience members will have the opportunity to ask questions of the poster authors after the presentations.

POSTER PRESENTATION ABSTRACTS

STUDENT POSTER COMPETITION

PDFs of all student competition posters will be made available exclusively to conference attendees at a secure website link provided prior to the conference.

GP-1:

A genetic analysis of the distribution of pheromone races of the European corn borer, *Ostrinia nubilalis* (Hübner), in Canada

Emily Glasgow[1], Rebecca Hallett[1] and Jocelyn Smith[2]
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[2]Department of Plant Agriculture, University of Guelph Ridgetown Campus, Ridgetown, ON

European corn borer, *Ostrinia nubilalis* (Hübner), is a major corn pest in Canada primarily managed using transgenic corn (*Zea mays* L.) expressing insecticidal proteins from *Bacillus thuringiensis* (Bt) since 1996. However, the first case of field-evolved resistance to a Bt protein was discovered in NS in 2018. To mitigate Bt resistance in *O. nubilalis*, distribution of pheromone races and host crops must be considered. There are two pheromone races of *O. nubilalis,* denoted *E* and *Z* for the ratio of 11-tetradecenyl acetate isomers in the pheromone blend. *Z*-race primarily infests corn, while E-race will develop on many vegetable crops. Genetic material was extracted from *O. nubilalis* collected mainly from corn in 2018 and 2019 in ON, QC, NS, NB, and PEI, and amplification and restriction enzyme digests were completed. Preliminary results indicate all samples collected from ON, NS, NB, and PEI are *Z*-race, while some *E*-race and hybrids were collected in QC. If Bt resistance is linked to *Z*-race, mitigation efforts could focus on controlling resistant populations in corn. If resistance is also present in *E*-race populations, mitigation efforts would also need to include other crops. Mating experiments will also be conducted to better understand Cry1F resistance in *O. nubilalis*.

GP-2:

Molecular detection of cyclamen mite (*Phytonemus pallidus*) in strawberry

Marlee-Ann Lyle[1], Amanda Naaum[2], Angela Gradish[1], Justin Renkema[3] and Rebecca H. Hallett[1]
[1]School of Environmental Sciences, University of Guelph, Guelph, ON
[2]Precision Biomonitoring, Guelph, ON
[3]Agriculture and Agri-Food Canada, Vineland, Ontario

Cyclamen mite, *Phytonemus pallidus*, is a widespread pest of strawberry. Cyclamen mite feeds on young plant tissue, which causes stunted plants and damaged fruit. Because it is small (~0.25 mm) and lives concealed in new growth, cyclamen mite is often undetected until populations are high and plant damage has occurred. The objective of our research was to develop a PCR-based method for detecting cyclamen mite in strawberry leaf samples. Cyclamen mite was collected from eight fields in Ontario and Quebec, Canada, and a sequence library of the barcoding region of the cytochrome oxidase subunit I (COI) gene was created using the primer pair Lep F/R. Sequences were assembled and aligned in Geneious Prime. A primer set for a 94 bp amplicon was designed and tested by amplifying cyclamen mite DNA that had already been successfully sequenced with end-point PCR and visualizing bands on a 5% agarose gel. Primer selectivity was determined by non-amplification of DNA from 20 arthropods that are known to occur on strawberry. Primer sensitivity was determined by amplifying decreasing concentrations of cyclamen mite DNA. Future experiments will be conducted to determine if these primers are compatible with direct PCR and qPCR methods. The outcome of this project will be a new method capable of detecting cyclamen mite at low population levels.

GP-3:

Soil treatments to suppress clubroot

Shauna Chesney[1], Bruce Gossen[2] and Mary Ruth McDonald[1]
[1]Department of Plant Agriculture, University of Guelph, Guelph, ON
[2]Agriculture and Agri-Food Canada, Saskatoon, SK

Clubroot (*Plasmodiophora brassicae*) is a soil-borne disease that affects canola and can cause 100% yield losses. Effective management strategies are needed. Both calcium and boron have been shown to suppress clubroot. Agricultural lime is a source of calcium and also raises the pH of soil with both suppressing clubroot severity. A field trial was conducted to test the hypothesis that the interaction of boron and calcium can suppress clubroot. Two rates of calcium hydroxide to achieve the pH's of 7.0 and 7.5 and one rate of boron (8 kg/ha) were broadcast two weeks before seeding clubroot susceptible canola. Canola was assessed for clubroot severity after 6 weeks. There was no interaction between calcium and boron and no differences between the treatments and untreated check. However, none of the treatments increased the pH above a mean of 6.8 and was not high enough to suppress clubroot severity. Higher pH was associated with lower disease severity (r^2 0.41, P>0.001). Tarping is used for solarization and to seal soil fumigants and has been shown to suppress clubroot. A field trial was performed to evaluate tarping, and the fumigant Vapam (metam sodium) to manage clubroot. Plots were either uncovered, covered with totally impermeable film, or treated with Vapam and covered. Plots remained covered for 2 weeks, were seeded with canola and assessed for clubroot severity at 6 weeks. Vapam with tarping reduced clubroot severity. Future research will involve higher rates of lime and boron and further investigation of tarping to suppress clubroot.

GP-4:

WITHDRAWN

GP-5:

Understanding efficacy of a novel nematicide for management of northern root knot nematode

Jerry Akanwari[1,2] and Tahera Sultana[1]
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[2] Department of Biological Sciences, Brock University, ON.

In recent years, Canadian growers have witnessed increasing plant parasitic nematode (PPNs) damage due to climate change and less effectiveness of cultural management practices. Northern root knot nematode (*Meloidogyne hapla*) is marked as one of them considering its wide host range. Agrochemical companies are responding to this challenge by development of new synthetic non-fumigant nematicides that are selective and environmentally friendly. In collaboration with Corteva Agriscience, we tested the efficacy of a novel nematicide (X) against *M. hapla* on cucumber. We applied product X at single and double concentrations and compared to Nimitz under greenhouse conditions. The results showed that double application of X at 1120g ai/ha followed by 280g ai/ha or 560g followed by 560g ai/ha significantly reduce the population of *M. hapla* compared to treatment without nematicides (control) but comparable to Nimitz as recommended. Also, double applications of X significantly reduced *M. hapla* root galling resulting in increased numbers of marketable cucumbers. Although, there was no significant difference in the number *of M. hapla* populations when X was applied at concentrations of 560 or 1120 g ai/ha, the number of marketable cucumbers were higher than control. Phytotoxicity tests taken at regular intervals during the experiment were not significantly different from the control, an indication of less or no environmental impact. Overall, these results indicate that double application of X is effective in reducing *M. hapla* populations and could be one of the new nematicides that can be used as part of integrated nematode management practices.

GP-6:

Suitability of *Euonymus* spp. for box tree moth (*Cydalima perspectalis*) survival and development

Abigail Wiesner[1], Jennifer Llewellyn[2], Sandy Smith[3] and Cynthia Scott-Dupree[1]
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[2]Ontario Ministry of Agriculture, Food and Rural Affairs, Guelph, ON
[3]Institute of Forestry & Conservation - Daniels Faculty, University of Toronto, Toronto, ON

Native to Asia, box tree moth (BTM) (*Cydalima perspectalis*) (Walker, 1859) is an invasive pest first confirmed in Toronto, Ontario in November 2018. The preferred host of BTM is boxwood (*Buxus* sp.), however, alternate hosts, including *Euonymus* species, have been documented within its native range. In the invaded range of BTM, there is negligible data available on the suitability of *Euonymus* hosts in terms of successful reproduction of the insect pest. Determining the suitability of alternative hosts for BTM survival and development is crucial for the nursery and landscape industry to understand any potential phytosanitary risks as well as trade implications. This research examined the alternate host suitability of two *Euonymus* species, *E. alatus* and *E. fortunei*. No-choice feeding experiments were conducted with BTM larvae using leaf-discs, individual leaves, and entire plants of each plant species. Markers such as leaf-area consumption, survival (response to stimulus) and development (progression of life stages) were evaluated.

GP-7

Characterizing the active space of pheromone traps for spruce budworm and *Lymantria dispar*

Joel Goodwin[1], Sandy Smith[1], and Jeremy Allison[2]
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The active space of a pheromone is described as the volume of air in which the pheromone concentration is above a threshold which elicits a behavioural reaction in the receiving individual. This is often evidenced by directed movement toward the source. This is an important concept to consider as researchers deploying pheromone-baited traps are often unsure of how far apart traps must be placed to ensure the largest area possible is sampled. Several methods have been proposed to assess active space including wingfanning assays, competitive trapping trials, mark release recapture experiments, and electrophysiological recordings. Here, we use wingfanning assays as a simple and reliable test to assess when odour concentrations surpass the behavioural threshold required by these organisms. We tested 2, 3, 4, and 5-day-old spruce budworm males and 2, 3, and 4-day-old *Lymantria dispar* males to determine the distance from the trap at which the moths wingfanned. We also used walking assays to assess whether active space changes outside of the preferred daily activity period of these moths. Our results suggest that moths are equally responsive to pheromone outside of their activity periods for both species tested. For spruce budworm, active space ranges from 12-23m, and, for *Lymantria dispar*, active space ranges from 90-112m. These findings provide a better understanding of moth olfaction and have potential applications in design of trapping programs as they may assist researchers in understanding when and how far pheromone-baited traps can function.

GP-8

Functional response and predatory capacity of a native generalist biological control agent, *Nabis americoferus* Carayon (Hemiptera: Nabidae), towards lepidopteran pests

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Current trends in biological control research emphasize the development of native natural enemies instead of a non-native predator or parasitoid importation. In North America, the generalist hemipteran predator *Nabis americoferus* Carayon (Hemiptera: Nabidae) has expressed in a recent study a high reproductive capacity on tomato crops and represents a tangible candidate for controlling many crop pests of significant economic value. With the potential invasion of the tomato leaf miner *Tuta absoluta* Meyrick (Lepidoptera: Gelechiidae) on the horizon, preparation is required to develop a natural enemy against these invasive pests. To better understand *N.americoferus*'s predatory capacity of lepidopteran pests, this study first examined the functional response of both 2nd instar and adult *N.americoferus* individuals to varying densities of flour moth, *Ephestia kuehniella* Zeller (Lepidoptera: Pyralidae) prey eggs. We demonstrated that these immature and adult predators had a daily mean consumption rate of 24 and 56 eggs, respectively. Predators of both life stages displayed a type II functional response based on Holling's disc equation for this prey type. In addition, consumption of eggs and first instar larvae of the lepidopteran pest *Trichoplusia ni* Hübner (Lepidoptera, Noctuidae) by adult female *N. americoferus* had a mean of 38 eggs, 56 first instar larvae, both reaching a maximum of 72 total, within a 24 hour period. These consumption levels suggest that *N.americoferus* has excellent potential for consuming lepidopteran pests, with important implications for invasive species management in North America.

UP-1 (UNDERGRADUATE)

Resistance of *Stemphylium vesicarium* in onions to azoxystrobin and fluopyram fungicides

Emily McFaul and Mary Ruth McDonald
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Stemphylium leaf blight (SLB), caused by *Stemphylium vesicarium*, has recently become an important disease of onion in the Holland Marsh. There are no onion cultivars resistant to *S. vesicarium*, and growers rely on fungicide applications at 10–14 day intervals to manage the disease. Fungicide resistance in *S. vesicarium* was documented in New York State and Ontario in 2017. Studies were conducted in 2020 to investigate changes in fungicide resistance. Thirty isolates of *S. vesicarium* from onions in southern Ontario were collected and assessed for resistance to azoxystrobin (FRAC 11) and fluopyram (FRAC 7), which are active ingredients of commonly used fungicides in the region. Two isolates collected from oats in Saskatchewan in 1995 were used as a historical baseline and were sensitive to both active ingredients when tested in 2017. Using a conidial germination assay, 97% (n=29) of isolates were resistant to 5ppm azoxystrobin, 70% (n=21) were resistant to 100ppm azoxystrobin and 100% (n=30) of the isolates were resistant to 10ppm fluopyram. A mycelial growth assay showed that most isolates (95%) were resistant to azoxystrobin and only 20% (n=6) of isolates were resistant to fluopyram. Information from this study revealed an overall increase in fungicide resistance compared to 2017. These fungicides have been extensively used in Ontario for control of *S. vesicarium* in the Holland Marsh but should be avoided as they will be ineffective in suppressing SLB. Additional studies examining *S. vesicarium* insensitivity to other fungicides and efficacy of alternative control methods are recommended.

UP-2 (UNDERGRADUATE)

Bacillus amyloliquefaciens based biocontrol formulations suppressed fusarium head blight and associated vomitoxin production in wheat under field conditions

Harguun Dogra[1,2], Jesse Hoage[2], Eman Mabed[2], Nicole Clark[1,2], Jay Chen[1,2], Saveetha Kandasamy[2], Soledad Saldias[2], Shimaila Ali[2] and G. Lazarovits[1,2]
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Bacillus amyloliquefaciens is a Gram-positive, spore-forming bacterium used commercially as both a biofertilizer and biocontrol agent in many agriculture and horticulture crops. Nearly 10% of its genome is involved in synthesizing antimicrobial metabolites and their corresponding immunity genes; Surfactin is the dominant antibiotic produced. Cyclic lipopeptides and volatiles produced at sub-lethal concentrations by plant-associated Bacilli trigger pathways of induced systemic resistance (ISR), which protect plants against pathogenic microbes, viruses, and nematodes. Our studies demonstrated that *B. amyloliquefaciens* isolates 94, 113, and 279 as a biocontrol formulation inhibited about 61 of 65 tested species of fungal pathogens. Growth room and field studies were conducted to determine if this bioformulation could control fusarium head blight (FHB) caused by *Fusarium graminearum* in wheat, a serious risk to global food security due to yield losses and mycotoxin accumulation (DON) in harvested grains. This formulation strongly inhibited the fusarium mycelial growth and reduced DON levels by 83% under lab conditions. In the field, it reduced the disease incidence up to 36%, severity up to 17%, and disease index up to 49% over the control. DON levels were reduced by 36 & 55% and the yield increase was 9 & 17% alone and when co-applied with chemical fungicides respectively under field conditions. Antibiotic gene expression analysis is under progress to determine the mode of action of this biocontrol formulation.

REGULAR POSTERS

PDFs of all regular posters will be made available exclusively to conference attendees at the secure website link provided to registrants prior to the conference.

RP-1

The Holland/Bradford Marsh Integrated Pest Management Program: Highlights from the 2021 season

Tyler Blauel and Mary Ruth McDonald
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The Ontario Crops Research Centre – Bradford operates an Integrated Pest Management Program and provides services to vegetable growers in the Holland/Bradford Marsh. The main objective is to provide growers with information about the risk of insect pests and diseases and when they should be controlled. This is accomplished by: scouting growers' fields for diseases, weeds, and insect pests, providing disease and insect forecasting information, identifying diseases, insect pests and weeds, and spore trapping to quantify spores of vegetable crop pathogens. In 2021, 55 commercial onion, carrot, celery and potato fields were scouted twice a week for 18 growers in the marsh. The forecasting models for diseases were BOTCAST (botrytis leaf blight of onion), DOWNCAST (onion downy mildew), BREMCAST (lettuce downy mildew), BSPCAST (Stemphylium leaf blight of onion) and TOMCAST (general leaf blights), along with models for white rot of onion and Sclerotinia white mold of carrot. Insect degree day models for carrot rust fly, onion maggot, aster leafhopper, tarnished

plant bug, cabbage maggot and seedcorn maggot were also used. A sample of 100 onions and carrots per field were assessed for below ground symptoms of diseases and insect damage prior to harvest. The forecasting models were useful for predicting disease, especially BSPCAST and DOWNCAST for Stemphylium leaf blight and downy mildew, respectively. Insect degree day models accurately predicted insect activity. Stemphylium leaf blight was present in all onion fields and downy mildew was only found in one commercial onion field. Harvest assessments for carrots will be completed this fall.

RP-2

Evaluation of a quantitative polymerase chain reaction assay for detection of *Ilyonectria mors-panacis* in soil

Komathy Prapagar [1], Sean Westerveld [2], Amy Shi [3], Mary Ruth McDonald[1] and Melanie Kalischuk[1]
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Ilyonectria mors-panacis is a soilborne pathogen and is the causal agent of both ginseng root rot and ginseng replant disease. These diseases can cause serious crop losses in ginseng gardens. Quantification of this pathogen in soil would be useful to assess the risk of cultivating American ginseng (*Panax quinquefolius* L.) at specific sites, as ginseng requires four to five years of growth before the roots can be harvested. A quantitative PCR assay was developed to quantify *I. mors-panacis* in soil samples. The primers were designed to amplify a portion of the internal transcribed spacer region of the ribosomal RNA operon of the pathogen. The primers detected *I. mors-panacis* in soils with and without replant disease. The assay was also highly specific for *I. mors-panacis* and more sensitive than previously developed detection assays. To evaluate the assay further, a randomized complete block design trial was assayed to detect *I. mors-panacis* in soils receiving different fumigation treatments. The assay distinguished differences in the amount of *I. mors-panacis* between chloropicrin fumigated soils and soils that were not fumigated. The chloropicrin treatment consistently had less *I. mors-panacis*, as more amplification cycles were required to detect the pathogen than in the soils that were not fumigated. The SYBR-Green qPCR assay developed in this research was successfully used for the assessment of different management strategies such as fumigation by quantifying *I. mors-panacis* in ginseng gardens. The results show the importance and success of chloropicrin fumigation to control *I. mors-panacis* in ginseng gardens in replant soils.

RP-3

Exploring native predatory hemipteran species for use as biological controls in Canadian vegetable production

Paige Desloges Baril[1,2], Lauren Des Marteaux[2] and Sherah VanLaerhoven[1]
[1]Department of Integrative Biology, University of Windsor
[2]Agriculture and Agri-food Canada, Harrow, ON

Insect pests, invasive species introductions, and increasing insecticide resistance are among the various challenges faced by Canadian tomato growers. Native predaceous insects are appealing biocontrol agents (BCAs) due to reduced ecological risk and fewer regulatory hurdles compared to non-native species, however few native species have been developed as BCAs to date. From our recent insect survey in Ontario we identified and established colonies of two native predatory *Dicyphus* species. To develop these species as BCAs for tomato, we must first assess their ability to displace and establish future generations in field tomato and determine their maximum prey consumption in the lab. To determine the predators' ability to disperse and consume prey at different levels of the tomato plant, individual predators will be released in a cage with prey adhered to different strata of the tomato plant and allowed four days to predate. Then, prey will be tallied from each strata. Population establishment will be measured by introducing mating pairs to field tomatoes and allowed 6 weeks to oviposit, followed by enumerating all nymphal stages. To determine the maximum prey consumption, we will quantify prey consumption per adult over 24 hours in laboratory arenas with large densities of various lepidopteran prey. These evaluations will provide the foundation necessary to develop these new native BCAs for commercial use by Canadian tomato growers.

RP-4

Insect pests & natural enemies associated with outdoor cannabis production in Canada

Lillian Auty[1], Rachael Vanstone[2], Jason Lemay[1] and Cynthia Scott-Dupree[1]
[1]School of Environmental Sciences, University of Guelph, Guelph, ON
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Following the 2018 legalization of recreational drug-type *Cannabis sativa* L. in Canada, the licensed area for outdoor cultivation has rapidly increased to meet growing demands. Cannabis grown outdoors, like most outdoor crops, is threatened by economically damaging arthropod pests and pathogens that we know very little about. There is increased concern amongst growers that research needs to be done to properly identify and subsequently manage arthropod pests in the field using effective integrated pest management (IPM) practices. This project involves the first Canadian survey of economically relevant insect pests and natural enemies associated with outdoor cannabis production at two different licensed operations in Ontario. Scouting observations at these operations were used to formulate a comprehensive list of economically important pests and natural enemies identified during the 2021 outdoor cannabis growing season (May to October). Within this list, the three most common insect pests include: cannabis aphid (*Phorodon cannabis),* two-spotted spider mite (*Tetranychus urticae*), and western flower thrips (*Frankliniella occidentalis*). The four most common associated natural enemies include: minute pirate bug (*Orius insidiosus*), convergent lady beetle (*Hippodamia convergens*), Asian lady beetle (*Harmonia axyridis*), and green lacewings (*Neuroptera: Chrysopidae*). These results provide insight to the dynamic relationships between cannabis and insects, both pest and beneficial, in this specialized agroecosystem.

RP-5

The need for an improved disease forecasting model for Stemphylium leaf blight of onion

Michael Kooy[1], Bruce Gossen[2] and Mary Ruth McDonald[1]
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[2]Agriculture and Agri-Food Canada, Saskatoon, SK

Stemphylium leaf blight (SLB), caused by the fungal plant pathogen *Stemphylium vesicarium* is an important foliar disease of onion in Ontario. The disease symptoms start as small, dark or tan water soaked lesions on the leaves that progress to severe leaf dieback. Resistance to common fungicides has been found in Ontario and could be increased due to over application of fungicides. Improved disease forecasting is needed to determine the optimum time to apply fungicides while reducing unnecessary fungicide application. A replicated field trial was established at the Ontario Crops Research Centre – Bradford to evaluate various spray timing models to reduce spray applications. Disease severity was relatively low in 2021 (33- 43%) and all disease forecasting models reduced disease severity and the number of fungicide spray applications. Improvements in disease forecasting are needed to identify when fungicide applications are not needed. This will also reduce fungicide insensitivity. Treatments included a calendar spray (7-10 days), 2 TOMcast model variations, and BSPcast model. TOMcast is effective for SLB on tomatoes and BSPcast was developed for SLB on pear. Each treatment was assessed weekly after the 3 leaf growth stage and until the onions lodged. Assessments were completed by rating disease percentage of the 3 most mature leaves of 20 plants for each treatment. A final assessment was established on August 16 by pulling 20 plants from each treatment and assessing each leaf into percentage of disease categories. Further research is needed to develop a disease forecasting model for SLB on onions.

RP-6

The impact of insecticide application timing and infestation load in the management of western bean cutworm, *Striacosta albicosta*, in edible dry beans

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Western bean cutworm (WBC; *Striacosta albicosta*) is a pest native to the Great Plains region of America that has expanded its range across the Midwestern states and into eastern Canada in the past decade resulting in significant damage in corn (*Zea mays*) and edible dry beans (*Phaseolus* spp.). Much remains unknown about the behaviour and management of WBC in dry beans. This field study was conducted to evaluate the impact of the timing of WBC infestation in dry beans and efficacy of various insecticide application timings. WBC egg masses or larvae were artificially infested into small plots of navy beans at 0, 7, or 14 days after pin pods stage and Coragen insecticide (250 mL ha^{-1}) was applied at 4, 11, 18, 25, or 32 days after infestation. The experiment was carried out in Ridgetown and Exeter, ON concurrently in 2021. Specific plants were monitored for feeding damage weekly, and dissected post-harvest to determine yield loss. Results should demonstrate reduced damage in treatments that received Coragen applications immediately following WBC infestations, and greater damage in treatments that received multiple WBC infestations and/or delayed insecticide application. This research will be used to inform treatment thresholds for WBC in dry beans in relation to bean growth stage and WBC development. Additional studies include an analysis of historical WBC pheromone trap data to investigate regional and agronomic trends in WBC incidence in Ontario field crops.

RP-7

Breeding program for *Varroa* mite resistance in Ontario honey bee populations

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The mite *Varroa destructor* is considered the main threat to honey bee health worldwide. In Ontario, *V. destructor* is responsible for the majority of overwinter colonies losses. *V. destructor* parasitizes larvae, pupae, and adult bees, feeding upon the fat body tissue and haemolymph (blood) of its hosts, *V. destructor* also is a vector of the Deformed wing virus (DWV) reducing the lifespan of infested bees. Beekeepers control mite infestations using synthetic miticides, but the mites develop resistance to their active compounds, compromising their efficacy. Accordingly, it is necessary to have different control strategies. One way of reducing the impact of *V. destructor* parasitism is to breed *Varroa*-resistant strains of honey bees. In this project, a bee breeding program is being implemented in Ontario since 2018 to select for lower and higher rates of *V. destructor* population growth (LVG and HVG, respectively), monitoring infection rates of DWV. Collaborative institutions are the Ontario Queen Breeders Association, the Ontario Beekeepers Association, and the University of Guelph, Honey Bee Research Centre. Preliminary results show a six-fold difference in mite population growth between the LVG and HVG colonies. Additionally, DWV levels and winter colony mortality are significantly lower in LVG colonies than in HVG colonies.

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