PROCINORTE
CANADA - MEXICO - USA

Supporting Agriculture in North America

Guided by Science, Improved Technologies and Science-based Policies

Agriculture and Agri-Food Canada

inifap
Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias

USDA

IICA

PLANT HEALTH TASK FORCE & FOCUS

PLANT HEALTH

Dr. José Isabel López-Arroyo

•Instituto Nacional de Invesgitacionces Forestales Agricola y Pecuarias (INIFAP)

Dr. Rose Hammond

•United States Department of Agriculture – Agricultural Research Service (USDA-ARS)

Dr. Della Johnston

•Agriculture & Agri-Food Canada (AAFC)

PLANT HEALTH

- Promote joint research projects
- Capacity building and linking specialists and projects for proactive research on invasive pests and diseases
- Promote knowledge sharing on pests/diseases of tri-lateral interest through several means
- Carry out outreach activities with other countries and regions in LAC

PLANT HEALTH TASK FORCE

- Plant Health Task Force (PHTF) was formed in 2011
  - Harmonize protocols and share knowledge for insect identification
- 1st meeting and workshop in Vineland, NJ., 2013
  - focused on Brown Marmorated Stink Bug (BMSB) and parasitoids
- 2014 Workshop in Washington, DC
  - DNA barcoding of insects; tour of USDA-ARS insect collections at the Smithsonian
- 2015 Workshop in Monticello, Mexico
  - Molecular Insect Taxonomy
- 2016 Workshop in Ottawa, ON, Canada
  - Pests & Diseases of Solanaceans in North America: Trilateral approaches for their management

PROCINORTE
CANADA - MEXICO - USA

PLANT HEALTH TASK FORCE WORKSHOP 2017

Beltsville, Maryland, U.S.A.

PROCINORTE
CANADA - MEXICO - USA

Initial Observations on the invasive Bagrada bug (Bagrada hilaris) in Mexico (Saltillo)

Reyna Ivonne Torres-Acosta*, Moisés Felipe Victoriano, Veronica Hernandez-Hernandez* , Richard A. Humber ** And Sergio Sánchez-Peña*

*Departamento de Parasitología,
Universidad Autonoma Agraria Antonio Narro
Saltillo, Coahuila, Mexico
**USDA-ARS, Ithaca NY

Bagrada hilaris (left) and *Murgantia histrionica,* (Harlequin bug)

Harlequin bug is usually
a very minor pest

Bagrada: PRIMARY PEST

Bagrada bug: Early season

Harlequin Bug: Late season

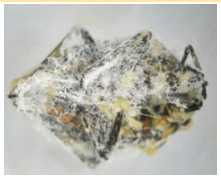
Harlequin: Usually low populations

In total, 213 naturally infected insects
by five genera of entomopathogenic fungi

Collected Insects : 600

Mycosed (infected) Insects : 213

Overall % infection: 35.5 %



Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Canada

PROCINORTE - Plant Health Task Force
Beltsville, Maryland. October 11 – 13, 2017

Parasitoid Exploitation of Native and Invasive Stink Bug Species in Canada: A Molecular Approach

Tara D. Gariepy
Agriculture and Agri-Food Canada
London Research and Development Centre
Ontario, Canada

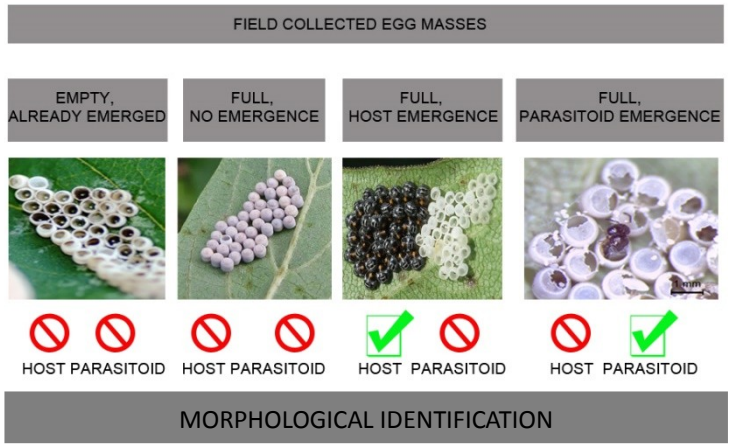
Agriculture and Agri-Food Canada

inifap
Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias

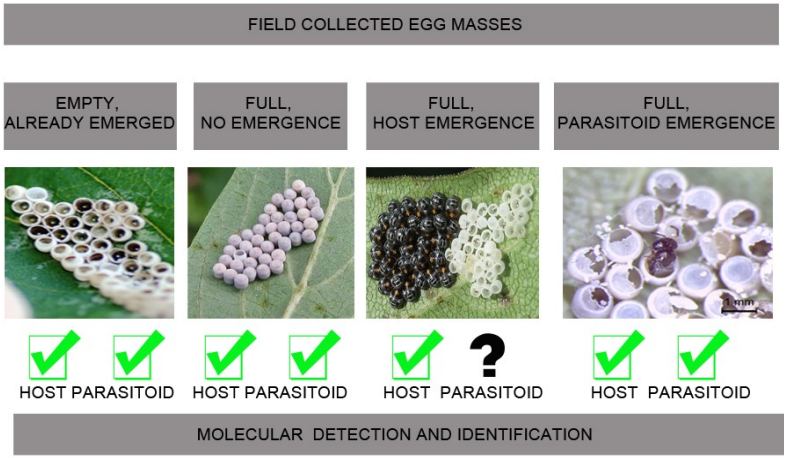
USDA

IICA

Egg Masses are Hard to Find!

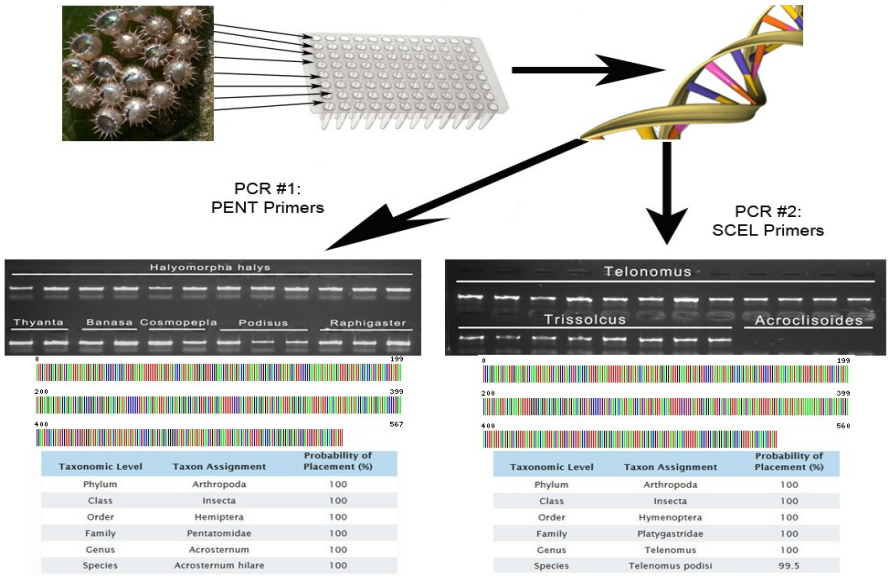


Molecular Tools?



Molecular Tools: Modified Barcoding

- DNA barcoding = great for identifying unknown species – large public database of sequences. BUT: Universal barcode primers = amplify everything
  - PCR primers specific to Pentatomidae and Scelionidae, nested within DNA barcode region
  - Identification of unknown or unexpected species for both host and parasitoid



Gariepy et al. 2013, Molecular Ecology

'*Candidatus* Phytoplasma': Tools for Detection and Identification

PROCINORTE – Plant Health Task Force Workshop

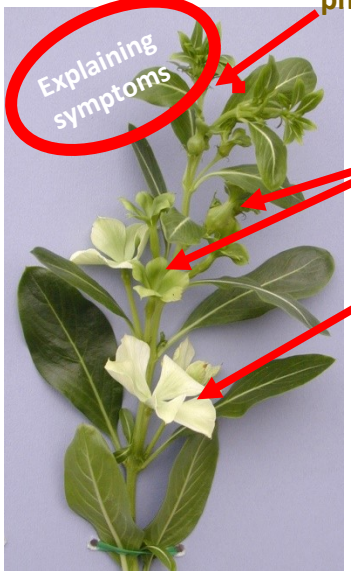
Working Beyond Boundaries to Secure Plant Health and Productivity

Beltsville, MD
October 11-13, 2017

Robert E. Davis

Molecular Plant Pathology Laboratory,

USDA-Agricultural Research Service, Beltsville, MD USA



Explaining Symptoms :

Phytoplasmal Infection Derails Meristem Fate and Alters Plant Architecture

The shoot meristem gradually transitions from vegetative to reproductive.

Each symptom corresponds to a distinct phase in meristem fate derailment.

Gene expression:
altered in relation to degree of stem cell commitment to floral destiny

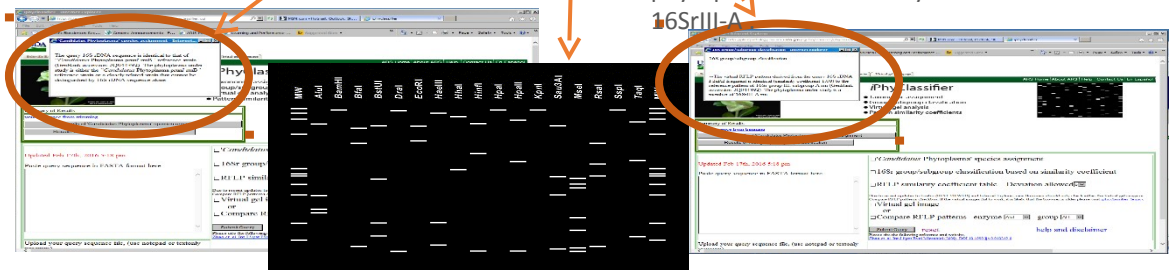
Wei et al. 2013. PNAS 110:10140-19154.

R.E. Davis USDA-ARS

*i*PhyClassifier output, example

16S rDNA sequence is identical to that of ''*Candidatus* Phytoplasma pruni' rrnB ' reference strain (GenBank accession: JQ044392). The phytoplasma under study is either the ''*Candidatus* Phytoplasma pruni' rrnB ' reference strain or a closely related strain that cannot be distinguished by 16S rDNA sequence alone.

16S group/subgroup classification --The virtual RFLP pattern derived from the query 16S rDNA F2nR2 fragment is identical (similarity coefficient 1.00) to the reference pattern of 16Sr group III, subgroup A rrnB (GenBank accession: JQ044392). The phytoplasma under study is a member of 16SrIII-A.



PROCINORTE - Beltsville, MD – 12 October 2017

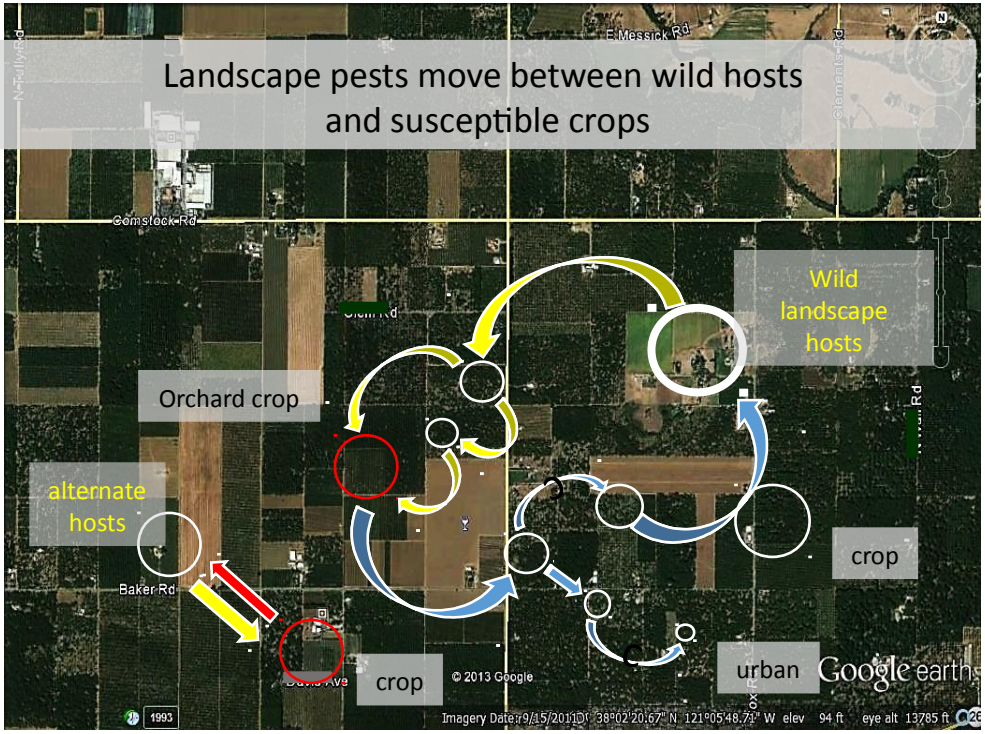
Invasive Pests: ARS Biological Control Update

Kim Hoelmer

USDA Agricultural Research Service

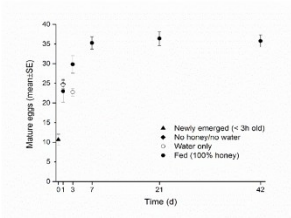
Beneficial Insects Introduction Research Unit

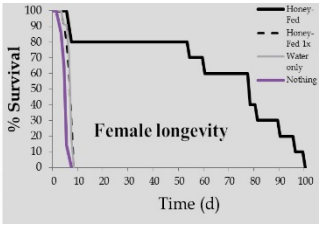
Newark, DE, USA



Trissolcus japonicus

"samurai wasp"

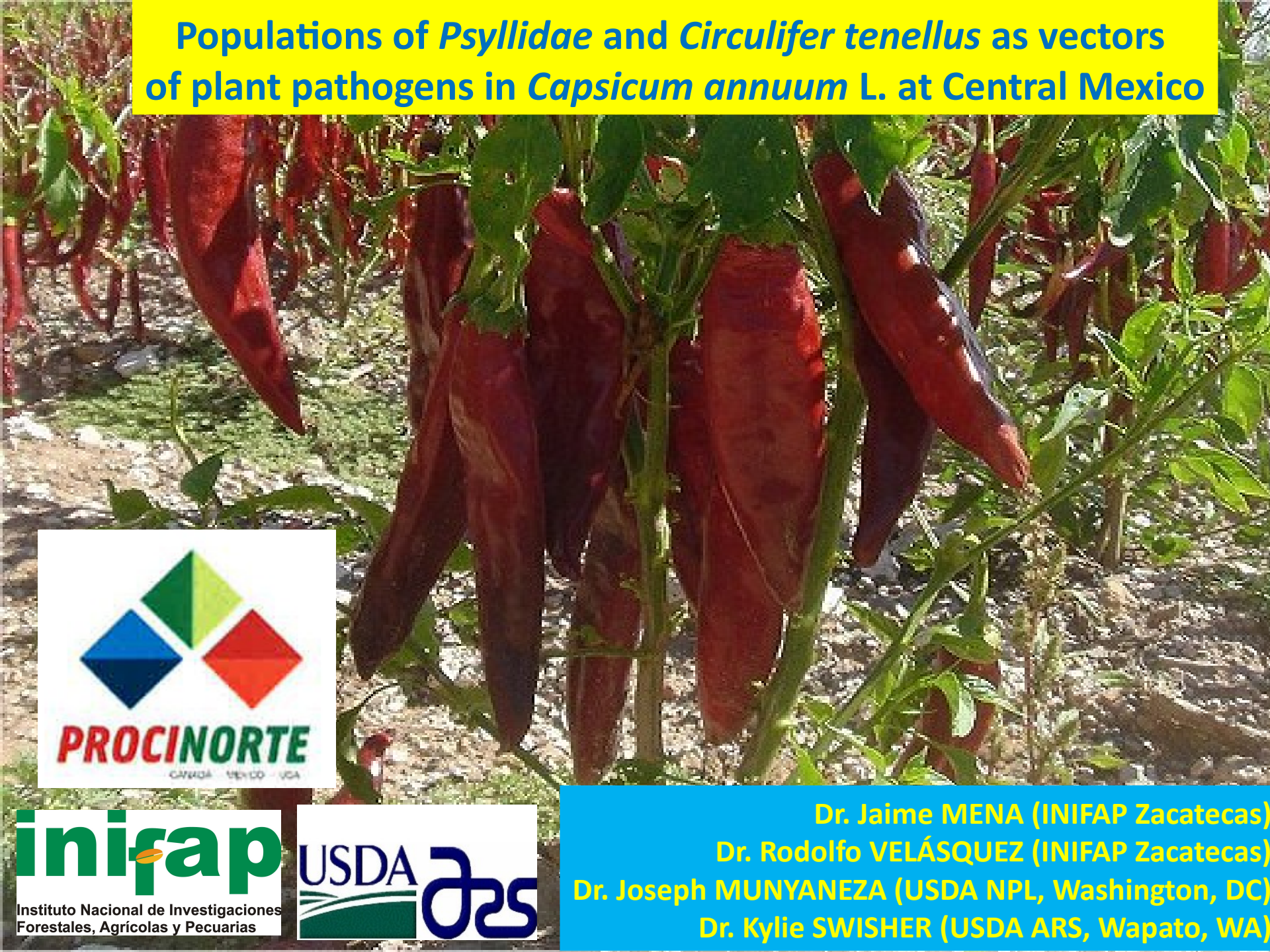




- **solitary egg parasitoid**
- **high % of eggs in mass attacked**
- **2 - 3 weeks / generation**
- **Sib-mating with female-biased sex ratio**
- **Parent females aggressively guard egg masses**
- **65 to 90% BMSB parasitism in Asia**

C. Dieckhoff/ARS

Populations of *Psyllidae* and *Circulifer tenellus* as vectors of plant pathogens in *Capsicum annuum* L. at Central Mexico



PROCINORTE
CANADÁ MÉXICO USA

inifap
Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias

USDA ARS

Dr. Jaime MENA (INIFAP Zacatecas)
Dr. Rodolfo VELÁSQUEZ (INIFAP Zacatecas)
Dr. Joseph MUNYANEZA (USDA NPL, Washington, DC)
Dr. Kylie SWISHER (USDA ARS, Wapato, WA)

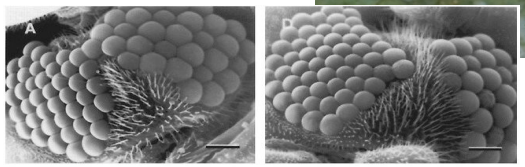
Many different Symptoms

SOME BIG BUD SYMPTOMS ON PEPPERS IN NEW MEXICO

Yellow foliage
Stunt growth
Witch broom
AND BCTV

Hyper leaf development, witch broom

Randall, J. J., Bosland, P. W., and Hanson, S. F. 2011. Brote grande, a new phytoplasma associated disease of chile peppers in the Desert Southwest. Online. Plant Health Progress doi:10.1094/PHP-2011-0301-01-RS.



Bemisia* vs *Trialeurodes
Vector vs No vector

Biology and natural enemies of the pepper weevil

Labbé, R., Fernandez, C., Hilker, R., Gagnier, D., McCreary, C., Gibson, G.A.P., Fernandez-Triana, J. Mason, P.G. and Gariepy, T.D.

Harrow Research and Development Centre

What parasitoids are present?
Three distinct *Nealiolus spp.*

Braconidae, Heliconinae

Dr. J. Fernandez-Triana

2017 IICA Research Internship Assistance Program

Catalina Fernandez, PhD Candidate

Dr. Rodriguez-Leyva

***Jaliscoa hunteri* female ovipositing on alternate host larva**

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Canada

Biology, Impacts, & Monitoring of the Tomato Leaf Mining Moth *Tuta absoluta* (Meyrick)

Julia Mlynarek, Ph.D.

(Julia.mlynarek@canada.ca)

Harrow Research & Development Centre

Ecological equivalent in North America

- *Tuta Absoluta*

- *Keiferia lycopersicella* (tomato pinworm)

- Other Species
  - *Sinoe capsana*
  - Native *Tuta* sp.

Parasitoids

- *Trichogramma* spp. – Aphelinidae (Argentina)
- *Encarsia poteri* – Aphelinidae (Europe & South America)
- *Apanteles* spp. – Braconidae (South America)
- *Bracon* spp. – Braconidae (endo) (Argentina)
- *Copidosoma* spp. – Encyrtidae (Argentina)
- *Campoplex haywardii* - Ichneumonidae (endo) (Argentina)
- *Diadegma ledicola* – Braconidae (endo) (Europe)
- *Habrocracon hebetor* – Braconidae (Mediterranean)
- *Temelucha* spp. – Ischneumonidae (endo) (Argentina)
- *Necremnus* spp. – Eulophidae (Europe)
- *Neochrysocharis formosus* – Eulophidae (Argentina)
- *Stenomesius* spp. – Eulophidae (Europe)
- *Pseudapanteles* spp. – Braconidae (endo) (Argentina)
- *Dineulophus phtorimaea* – Eulophidae (Europe & Argentina)
- *Spilochalcis* spp. – Chalcididae (Argentina)

The USDA National Plant Diagnostic Network: Protecting US Agriculture

Rubella S. Goswami

National Program Leader
Institute of Food Production and Sustainability

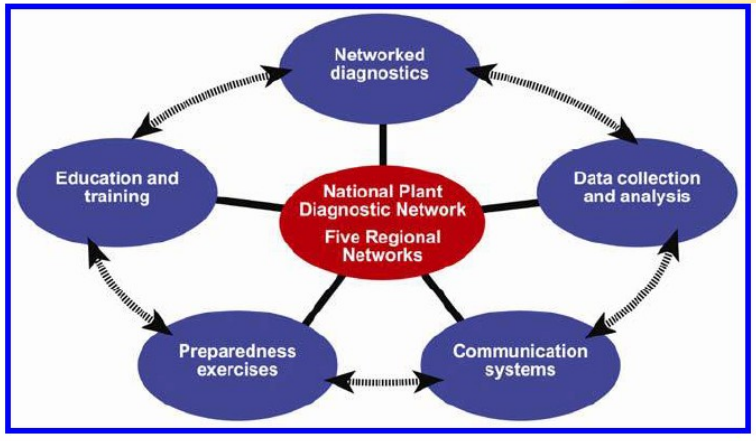
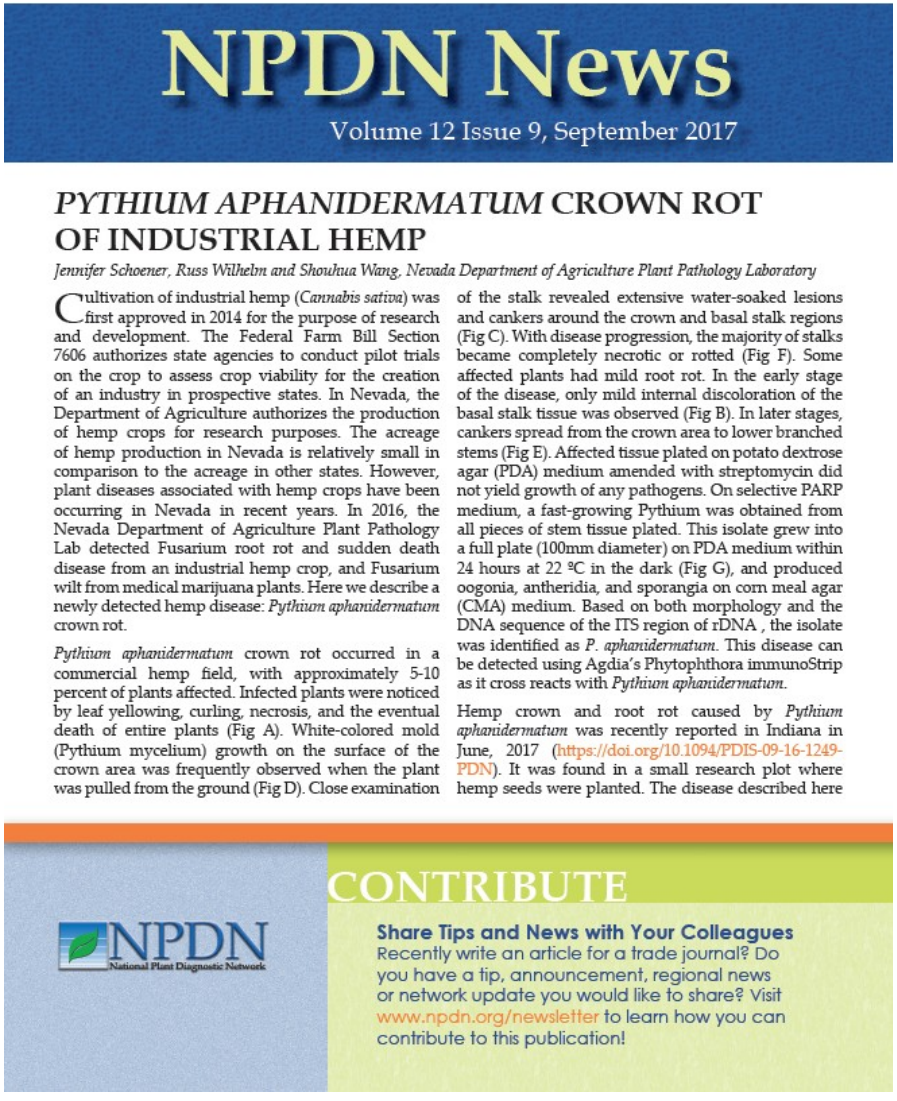


Fig. 1. The National Plant Diagnostic Network (NPDN) was established as one component of a national plant biosecurity system. NPDN goals include: (i) establish a national communications system linking all plant diagnostic laboratories, (ii) upgrade the diagnostic infrastructure in state diagnostic labs, (iii) provide advanced training to diagnosticians, (iv) provide training to "first detectors" to facilitate the early detection and reporting of outbreaks, and (v) develop data capture and analysis capabilities for the rapid identification of outbreaks.

Stack et al., 2006

http://www.npdn.org



NPDN News

Volume 12 Issue 9, September 2017

PYTHIUM APHANIDERMATUM CROWN ROT OF INDUSTRIAL HEMP

Jennifer Schoener, Russ Wilhelm and Shouhua Wang, Nevada Department of Agriculture Plant Pathology Laboratory

Cultivation of industrial hemp (*Cannabis sativa*) was first approved in 2014 for the purpose of research and development. The Federal Farm Bill Section 7606 authorizes state agencies to conduct pilot trials on the crop to assess crop viability for the creation of an industry in prospective states. In Nevada, the Department of Agriculture authorizes the production of hemp crops for research purposes. The acreage of hemp production in Nevada is relatively small in comparison to the acreage in other states. However, plant diseases associated with hemp crops have been occurring in Nevada in recent years. In 2016, the Nevada Department of Agriculture Plant Pathology Lab detected Fusarium root rot and sudden death disease from an industrial hemp crop, and Fusarium wilt from medical marijuana plants. Here we describe a newly detected hemp disease: *Pythium aphanidermatum* crown rot.

Pythium aphanidermatum crown rot occurred in a commercial hemp field, with approximately 5-10 percent of plants affected. Infected plants were noticed by leaf yellowing, curling, necrosis, and the eventual death of entire plants (Fig A). White-colored mold (Pythium mycelium) growth on the surface of the crown area was frequently observed when the plant was pulled from the ground (Fig D). Close examination of the stalk revealed extensive water-soaked lesions and cankers around the crown and basal stalk regions (Fig C). With disease progression, the majority of stalks became completely necrotic or rotted (Fig F). Some affected plants had mild root rot. In the early stage of the disease, only mild internal discoloration of the basal stalk tissue was observed (Fig B). In later stages, cankers spread from the crown area to lower branched stems (Fig E). Affected tissue plated on potato dextrose agar (PDA) medium amended with streptomycin did not yield growth of any pathogens. On selective PARP medium, a fast-growing Pythium was obtained from all pieces of stem tissue plated. This isolate grew into a full plate (100mm diameter) on PDA medium within 24 hours at 22 ºC in the dark (Fig G), and produced oogonia, antheridia, and sporangia on corn meal agar (CMA) medium. Based on both morphology and the DNA sequence of the ITS region of rDNA , the isolate was identified as *P. aphanidermatum*. This disease can be detected using Agdia's Phytophthora immunoStrip as it cross reacts with *Pythium aphanidermatum*.

Hemp crown and root rot caused by *Pythium aphanidermatum* was recently reported in Indiana in June, 2017 (https://doi.org/10.1094/PDIS-09-16-1249-PDN). It was found in a small research plot where hemp seeds were planted. The disease described here

https://www.npdn.org/newsletter

Changing genetics of the mycotoxin-producing pathogen *F. graminearum*: implications for mycotoxin surveillance

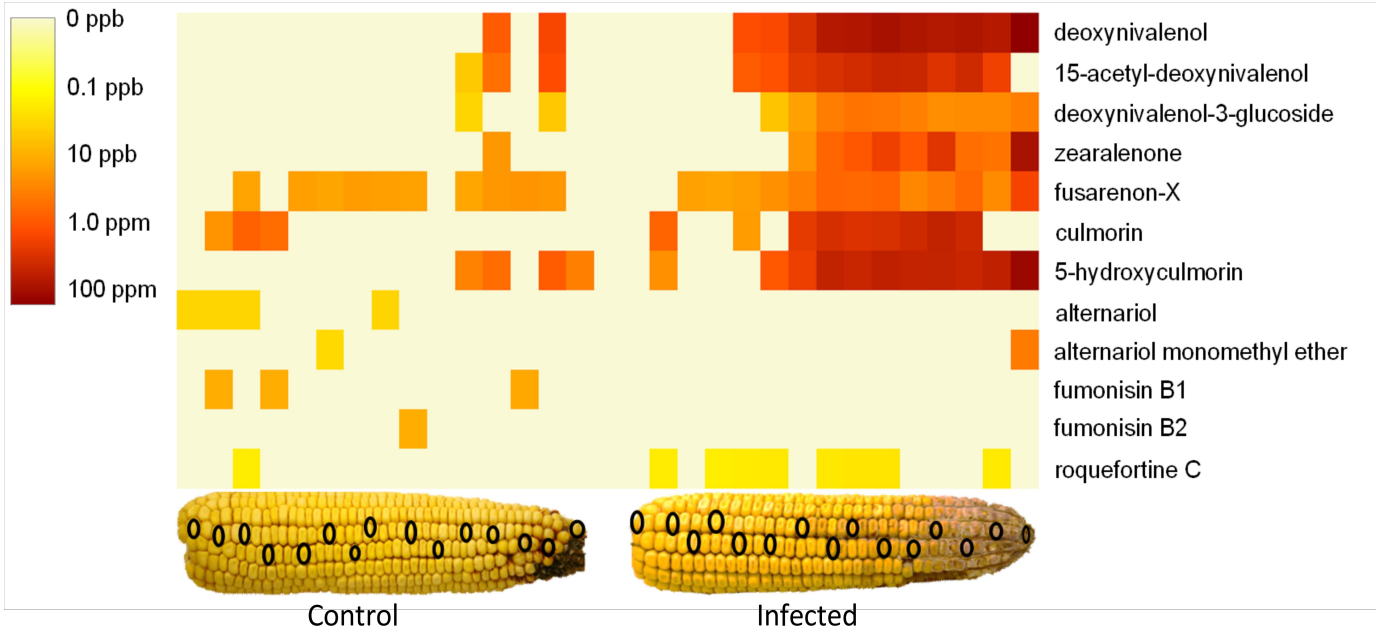
Mark Sumarah

October 13th 2017

F. graminearum – 4 or more chemotypes? (implications for monitoring)

Deoxynivalenol (DON) **3-acetylDON** **Nivalenol (NIV)** **15-acetylDON** **NX**

Detection of mycotoxins from maize (spectral library)

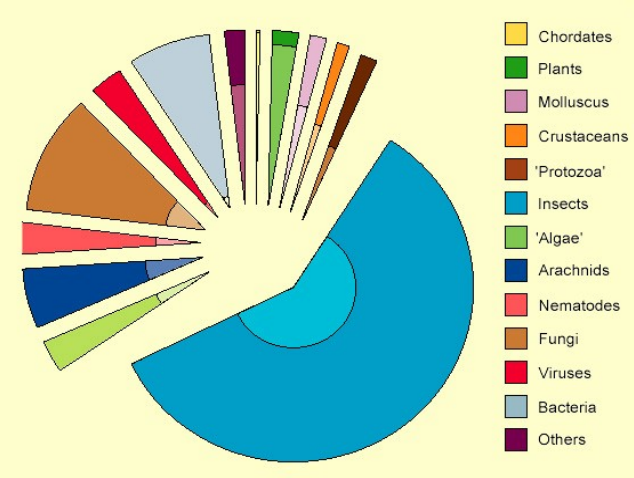


USDA United States Department of Agriculture

Fungal identification in a regulatory environment

Megan Romberg
National Taxonomic Specialist in Mycology
USDA, APHIS, PPQ National Identification Services
Beltsville MD

Estimated number of species vs. described number of species



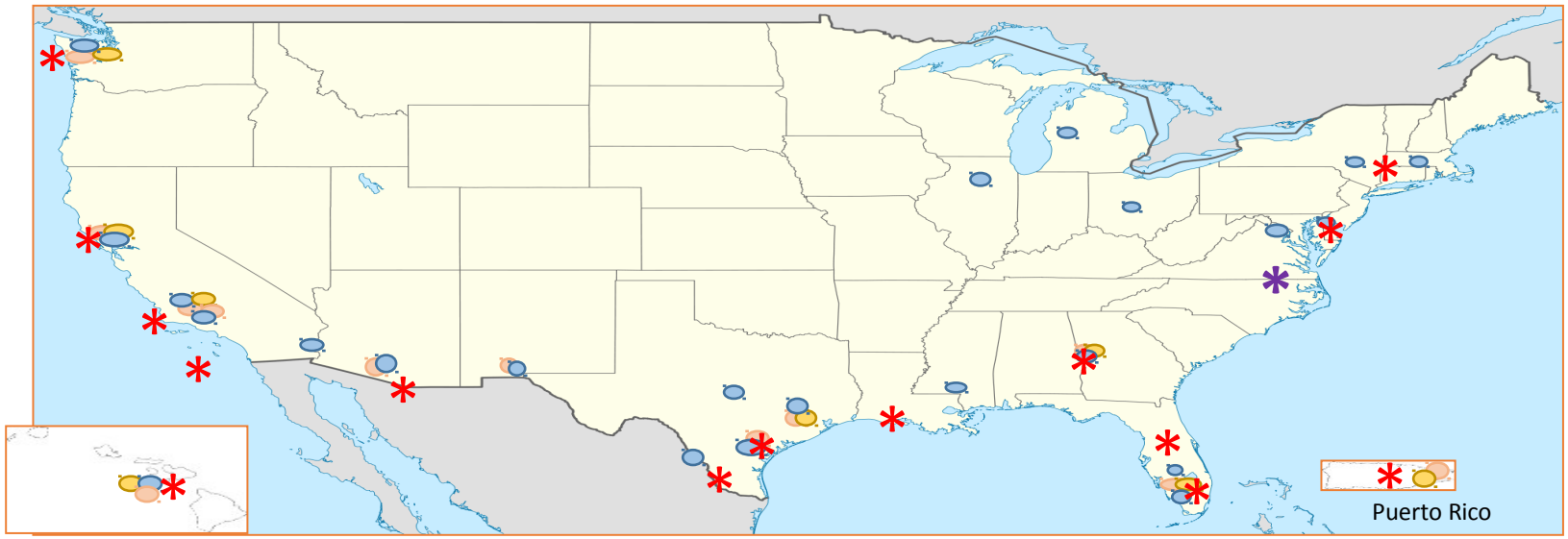
Hawksworth, D. L.& Kalin-Arroyo, M. T. in Global Biodiversity Assessment (ed. Heywood, V. H.) 107– 191 (Cambridge Univ. Press, Cambridge, 1995).

Port of Entry identifier locations

B Botany identifiers

E Entomology identifiers

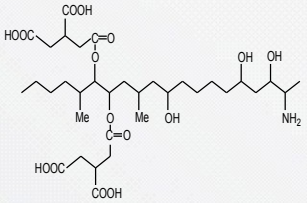
P Pathology identifiers



* Plant Inspection Stations

Workshop "Working Beyond Boundaries to Secure Plant Health and Productivity"

INIFAP's Research on Mycotoxins in Crops of Southern Mexico



Eduardo R. Garrido-Ramírez
Francisco J. Cruz-Chávez
Néstor Espinosa-Paz
Elizabeth Hernández-Gómez
Carolina Orantes-Garcia

October 11 - 13, 2017 Beltsville, Maryland

SAGARPA
SECRETARÍA DE AGRICULTURA, GANADERÍA, DESARROLLO RURAL, PESCA Y ALIMENTACIÓN

inifap
Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias

PROCINORTE
CANADA · MEXICO · USA

USDA ARS

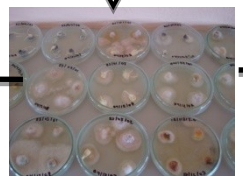
Agriculture and Agri-Food Canada

Isolation, identification and monosporic culture selection.

Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias

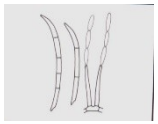
Samples PV2006

Single spore colonies



Isolation on PDA-A

Morphological identification



Conservation

Mycotoxins determination

221 samples analyzed

- Absorbance lecture
- RIDASOFT sofware

ELISA Kit
RIDASCREEN FAST (R-Biopharm)

immunoaffinity columns on coffee

E-probe Diagnostic Nucleic acid Analysis (EDNA) for plant pathogen detection

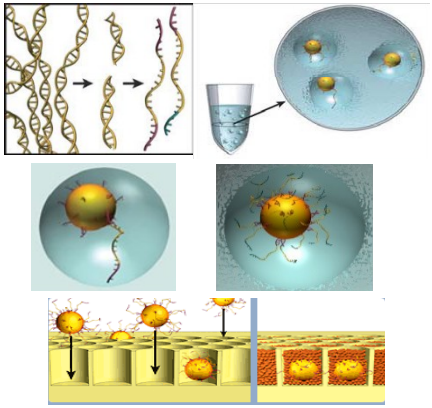
Jacque Fletcher
Ulrich Melcher
Francisco Ochoa Corona
Carla Garzon
Tony Stobbe
Jon Daniels
Andres Espindola
Ruchi Verma
Trenna Blagden
Sharon Andreason
Astri Wayadande
Oklahoma State University
Stillwater, OK

William L. Schneider
Diana Sherman
Andrew Stone
Aaron Sechler
USDA-ARS FDWSRU
Fort Detrick, MD

United States Department of Agriculture

National Institute of Food and Agriculture

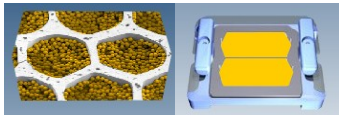
Nextgen Sequencing



Thousands and thousands of short sequences generated for a given DNA sample (e.g. Roche 454, AB SOLiD, Solexa)

Comprehensive picture of the entire microbial profile

Can sequence 400 megabases of DNA per 4.5-hour run. Enough to fully sequence 2 bacterial genomes



EDNA:
E-probe Diagnostic Nucleic acid Analysis

Bioinformatics tool designed to ignore irrelevant sequences and limit processing

Control the size of the reference database: Dump raw non-assembled sequence data into its own database (create a mini-genbank).

Control the size of the query set: Query the raw sequence data base with a series of signature diagnostic sequences ("e-probes").

Stobbe et al., Journal of Microbiological Methods
doi: 10.1016/j.mimet.2013.07.002

EDNA results

- Detects RNA and DNA viruses
- Detects bacteria
- Detects oomycetes and fungi
- Detects vectors
- Useful in pathogen discovery

USDA NIFA
United States Department of Agriculture
National Institute of Food and Agriculture

Invasive Stink Bugs: Applied Semiochemistry (and a little bit about Biological Control)

Don Weber
USDA Agricultural Research Service
Insect Biocontrol & Behavior Lab
Beltsville, Maryland

PROCINORTE Plant Health Task Force
Workshop in Beltsville, 12 October 2017

Pentatomidae: 22 genera (±) for which pheromones are known (at least partially)

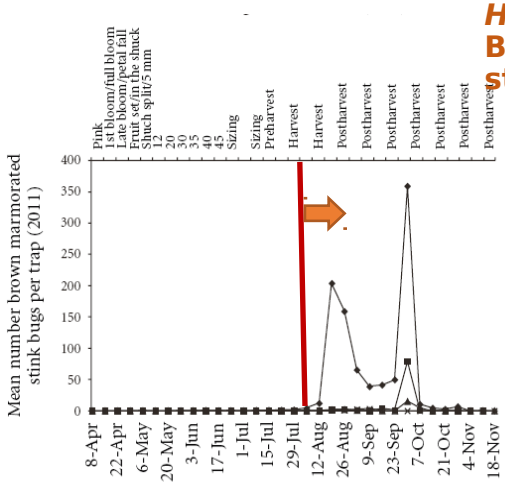
Asopinae: ***Oplomus***
- ***Perillus***
- ***Podisus***
- ***Stiretrus***
- ***Tynacantha***

Edessinae: ***Edessa***

Pentatominae:
- **Antestiini:** ***Plautia***
- ***Thyanta***
- **Cappaeini:** ***Halyomorpha***

Pentatominae (cont'd):
- **Carpocorini:** ***Agroecus***
- ***Euschistus***
- ***Oebalus***
- ***Tibraca***
- **Eysarcorini:** ***Eysarcoris***
- **Nezarini:** ***Chinavia***
- ***Chlorochroa***
- ***Nezara***
- **Pentatomini:** ***Pallantia***
- ***Pellaea***
- **Piezodorini:** ***Piezodorus***
- **Rhynchocorini:** ***Biprorulus***
- **Strachiini:** ***Murgantia***

Captures using black pyramid traps baited with MDT (50mg)
in VA & MD apple orchards, 2011



Halyomorpha halys
Brown marmorated stink bug

Asian native responsive to MDT

but usually only after harvest of apple crop, in late season

Rice stink bug (Brazil)
Pentatominae: Carpocorini

Harlequin bug
Pentatominae: Strachiini

Brown marmorated stink bug
Pentatominae: Cappaeini

Leskey et al. 2012, Psyche 2012: 535062, Figure 5b. Also shown by Khrimian et al. 2007, J.Ag.Food Chem.56: 197-203.

photos from: hotsites.cnpaf.**embrapa**.br/percebio; Alex Surcică by permission; Wil Hershberger ARS

PLANT HEALTH TASK FORCE

- **Relevance**
  - Insect pests, plant pathogens and associated toxins with potential to become invasive are a primary concern for each of the 3 countries
- **Effectiveness**
  - Researchers in each of the 3 countries provide expertise in identification of native and invasive pests, plant pathogens and associated toxins
- **Impact**
  - Researchers collaborate and share information on native biological control agents (predators, parasitoids and entomopathogens) for control of invasive pests to other member countries

PROCINORTE
CANADA - MEXICO - USA

PLANT HEALTH TASK FORCE WORKPLAN AND BUDGET REQUEST 2018

- INIFAP National Project Lead for Plant Health will host a 2 ½ day workshop in Mexico (location TBD) in fall 2018
- Workshop will focus on:
  - Hemipteran insect pests and diseases that are vectored by them.
  - Targeted pests include: Bagrada bug, Kudzu bug, Brown Marmorated Stink Bug, Pepper Weevil and Ambrosia Beetle. Tree fruits and small fruits will be the target host of the vectored viruses. In the case of Ambrosia beetle, *Fusarium* will be the vectored disease organism.

PLANT HEALTH TASK FORCE WORKPLAN AND BUDGET REQUEST 2018

- **Outcomes**
  - Knowledge transfer leading to harmonization of taxonomic methods in Canada, Mexico and U.S.A.
  - Tri-lateral collaboration and coordination of research in the area of insect pests and insect vectored diseases
  - Developing and enhancing networks of entomologists, pathologists and chemists in the three countries
- **Budget requested - $19,500**
  - To support travel of 10-15 scientists to workshop
  - Deliver Workshop
  - Sponsor participation at NAPPO 2018 (Tucson, Arizona, USA)
  - Sponsor participation at Entomology 2018 (Vancouver, BC, Canada

PROCINORTE
CANADA - MEXICO - USA

Thanks!

- **PROCINORTE and IICA**
  - Audia Barnett & Gloria Ramirez
- **INIFAP**
  - Dr. José Isabel López-Arroyo; Dr. Sergio Sánchez-Peña, UAAAN; Dr. Jaime Mena-Covarrubias, INIFAP; Dr. Eduardo R. Garrido-Ramírez, INIFAP
- **USDA/ARS**
  - Dr. Rose Hammond; Dr. Joe Munyaneza; Dr. Donald Weber, USDA/ARS; Dr. Kim Hoelmer, USDA/ARS; Dr. Rubella Goswami, USDA/NIFA; Dr. Robert E. Davis USDA/ARS; Dr. Ronald Ochoa, USDA/ARS; Dr. Gary Bauchan
- **AAFC**
  - Dr. Della Johnston; Dr. Roselyne Labbé; Dr. Tara Gariepy; Dr. Mark Sumarah; Dr. Wen Chen; Dr. Julia Mlynarek

PROCINORTE
CANADA - MEXICO - USA

PROCINORTE
CANADA - MEXICO - USA

Supporting Agriculture in North America

Guided by Science, Improved Technologies and Science-based Policies

THANK YOU!!

Agriculture and Agri-Food Canada

inifap
Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias

USDA

IICA