

Feed the Future: Innovation Lab for Integrated Pest Management

Trip Report

Program Title: Strengthening Production and Export of Vietnamese Fruit Crops Through IPM

Country Visited: Vietnam, **Dates of Travel:** 12-24 February 2017

Travelers' Names and Affiliations: Dr. Russell F. Mizell, III, Mizellidae, LLC, Professor Emeritus, University of Florida

Purpose of Trip: Provide expertise on IPM program development and entomological information for the Vietnam Project on export of longan, litchi, dragon fruit and mango.

Sites Visited: Ho Chi Minh City and Tien Giang, Vietnam. The main site in Tien Giang was SOFRI, the headquarters for the project "Strengthening production and export of Vietnamese fruit crops through IPM."

Description of Activities/Observations:

Met with cooperating scientists and administrators of the project over nine days discussing major issues associated with the project, gave seminars and taught informal classes concerning relevant topics, toured the facilities, plantings and surrounding areas including outlying orchards, producer and SOFRI orchards and local nurseries.

Training Activities Conducted:

Program type (workshop, seminar, field day, short course, etc.)	Date	Audience	Number of Participants		Training Provider (US university, host country institution, etc.)	Training Objective
			Men	Women		
Group Discussions	14-23 Feb.	Variable # of scientists daily	1-8	1-3	Russ Mizell	Overview: To convey information and knowledge of arthropod biology, ecology and behavior and corollary subject matter (monitoring methods, vector-pathogen interactions, experimental design) for specific pests and general IPM program development
Informal talk and discussion	14-15 Feb.	Variable # of scientists daily	1-8	1-3	Russ Mizell	Indepth discussion of the Longon witches broom problem: previous research, unknowns, and potential focus for future experimentation; field visits and continuation post field trip

Informal talk and discussion	14-23 Feb.	Variable # of scientists daily	1-8	1-3	Russ Mizell	Biological control of mite pests with natural enemies and the use of predatory mites as biological control agents. Advantages, disadvantages, field sampling, rearing methods, pitfalls, and experimental methods
Informal talk and discussion	21 Feb.	Variable # of scientists daily	1-8	1-3	Russ Mizell	*Plant-arthropod interactions: The importance of understanding biology, ecology and behavior of target pests and their natural enemies. A mechanistic approach to developing and implementing effective strategies and tactics in IPM programs. The Vinson heuristic model of parasite behavior was used to categorize and relate key issues necessary to understand and exploit possible temporal and spatial relationships that may provide effective pest suppression
Informal talk and discussion	14-23 Feb.	Variable # of scientists daily	1-8	1-3	Russ Mizell	Vector- pathogen-host plant-interactions: similar to above with major components discussed and emphasis on vector behavior and the limitations of suppressing vectors. Also, used Potting et al. (Ecol. Modeling 2005) paper to convey the potential and limitations of understanding insect behavior from a “global” perspective in applying various habitat manipulations strategies and tactics for different arthropod pest groups
Informal talk and discussion	14-23 Feb.	Variable # of scientists daily	1-8	1-3	Russ Mizell	Monitoring and sampling methods, binomial models and the potential use of factors other than arthropod numbers for prediction and treatment threshold device

Informal talk and discussion	14-23 Feb.	Variable # of scientists daily	1-8	1-3	Russ Mizell	Use and development of common heuristic tools for research planning and technology transfer to stakeholder groups. The importance, use and illustration pictorially of the key developmental stages and the relationships between crop and pests phenology by latitude, cropping cycles or other determinate factors
Informal talk and discussion	14-23 Feb.	Variable # of scientists daily	1-8	1-3	Russ Mizell	Quarantine procedures and how they are developed and implemented in the U.S.
Informal talk and discussion	21-23 Feb.	Variable # of scientists daily	1-8	1-3	Russ Mizell	Use of entomophagous nematodes in biological control of wood borers and other difficult pests in cryptic habitats, including the use of newly-discovered (Barracade™) enhancing techniques
Informal talk and discussion	14-23 Feb.	Variable # of scientists daily		1	Russ Mizell	Female scientists as leaders and mentors: background, resources, methods, tools, techniques and their relative importance.
Informal talk and discussion	14-23 Feb.	Variable # of scientists daily	1		Russ Mizell	Developing a research program surrounding the collection, rearing, and implementing as IPM tools native entomophagous nematodes
Formal Seminar, ~2 hrs, including question/answer and discussions	20 Feb. 2017	SOFRI scientists	6	6	Russ Mizell	The use of habitat manipulations to augment ecosystem services and the underlying theory, creation and implementation of a unique trap cropping strategy for stink bugs
*Please note that all of these informal presentations and discussions were supplemented with typical figures, tables and other communication tools (many would be found in IPM text books or regular extension publications, etc.) that were used to illustrate points being made and were provided to the participants to go with their notes. In addition, a complete set of reprints in pdf of my relevant refereed published papers (n=~120) were provided to the participants.						

Suggestions, Recommendations, and/or Follow-up Items:

- Focus future research on the buds of longan trees because the associated eriophyid mite apparently transmits or induces the witches broom syndrome in that plant part. Leaf sampling is unlikely to provide additional information
- Use live buds or other living preparations (see below) in experiments to determine underlying mechanisms of transmission, etc., as well as for determination of efficacy of mitigation tools
- Test the feasibility, and if possible, develop a binomial field-sampling method based on eriophyid mite presence/absence or damage levels in buds as a means of predicting the optimum timing of suppression tactics against witches broom in longan

- Utilize landscape-level sampling methods with a source-sink approach to quantify and map pest and associated natural enemy population dynamics in fruit, both inside and outside the orchards. Learn to use and analyze the data with an open source GPS software such as GRASS
- Evaluate least toxic and biorational pesticides for pest suppression including pyrethrins, spinosad, Grandevo, neem formulations, Surround™ kaolin clay, insect growth regulators, plant growth regulators, insecticidal soaps and oils that reduce the risk of insecticidal resistance development where appropriate to reduce costs and the impact of chemicals on natural enemies, workers and the environment
- Develop and implement an insecticide rotation for each crop by mode of action that is known (see literature) to reduce development of insecticidal resistance and include biorational tools where appropriate
- Recommend discontinuing use of synthetic pyrethroid insecticides, especially in early season, to reduce the risk of a initiating a “pesticide treadmill”, early season destruction of natural enemies, and inducement of secondary pest species into primary pests
- Develop a range of conventional heuristic devices to summarize relationships of pest and crop phenology for key areas of crop production in Vietnam, and.....
- Use the conventional heuristics that were discussed (phenology maps of crop, pest and production cycles) for developing research objectives and to explain clearly during technology transfer events why and how production practices and cost-saving decisions can be made more effectively using the underlying spatial and temporal components
- Capture, culture and evaluate native entomophagous nematodes (EPNs) for biological control of appropriate pests in the four target fruit crops and others. Investigate the addition of Barracade™ (see literature by Shapiro-Ilan et al.) as an adjuvant to enhance EPN efficacy under dry habitat conditions such as tree trunks for borers

Follow-up Items:

- Obtain the U.S.A. regulations that specify pest species-specific strategies and tactics along with thresholds, legal insecticides and insecticide residues, etc., that impinge on the entire export channel for each fruit crop; then use them for research planning, implementation of suppression strategies and tactics, and in technology transfer
- Collect, identify to species, and evaluate the efficacy as biological control agents of the predatory mites (and other potential natural enemies as appropriate) attacking the eriophyid mite vectors of witches broom; develop strategies to conserve and augment if appropriate
- Develop other methods such as tissue culture and rooted cuttings for working with longan germplasm, i.e., buds, to standardize handling and to facilitate laboratory and greenhouse experimentation
- Begin thinking and developing an agri-ecosystem mindset and a landscape-level approach to pest suppression looking beyond the target planting, characterize production habitats accordingly, and implementing habitat manipulations and other ecosystem-level strategies where appropriate. Caution, the presence of high biodiversity does not always directly translate into pest suppressive landscapes where

or when needed. Key components to effective targeted pest suppression may be missing even in midst of high vegetation biodiversity

- Develop and publish technology transfer tools that provide producers and other stakeholders key information and knowledge of crop production practices and needs
- Test biorationals and other least toxic insecticides against target pests and accompanying natural enemies under laboratory and field conditions

List of Contacts Made:

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