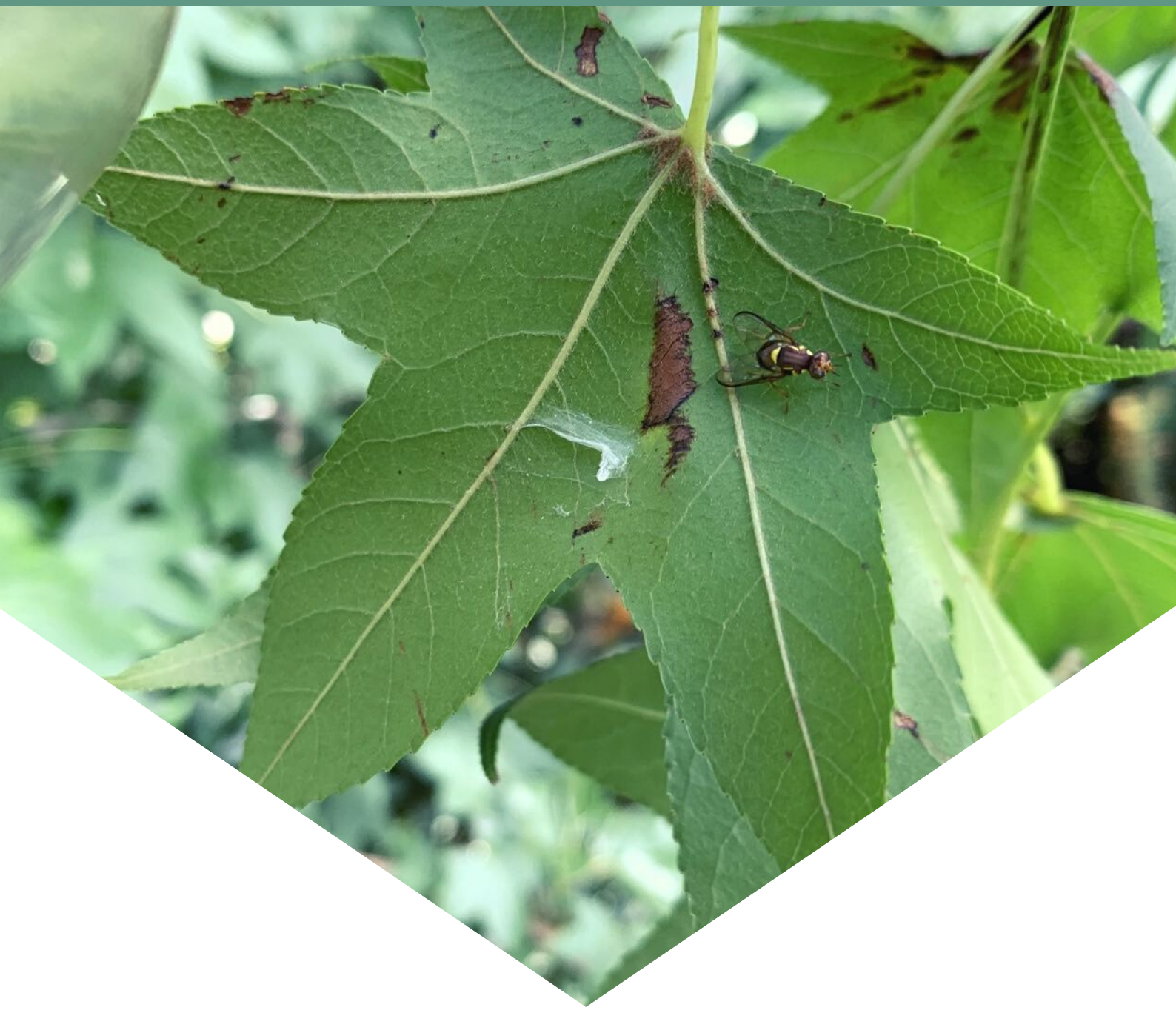
ARC CENTRE FOR FRUIT FLY BIOSECURITY INNOVATION

supported by Research Attraction and Acceleration Program of NSW Department of Industry



4-25 June 2020

Fruit Fly Chemical Ecology

Online Workshop

Program

June 2020

Australian Eastern Standard Time
Sydney NSW (GMT+10)

WEEK 1 - INTRODUCTION TO CHEMICAL ECOLOGY

THURSDAY 4 JUNE — 10.45 am - 12 pm

Introductions

Distinguished Prof. Phil Taylor, Director of the Fruit Fly ITTC Biosecurity Innovation

Chemical ecology perspective: Introduction to the development and application of fruit fly attractants

Prof. Matthew Siderhurst

WEEK 2 - OLFACTION AND ELECTROPHYSIOLOGY

MONDAY 8 JUNE — 11 am - 12 pm

How do fruit flies smell and taste?

Dr Wei Xu

THURSDAY 11 JUNE — 11 am - 12 pm

Sensory electrophysiology in insect semiochemical research

Dr Kye-Chung Park

Program

June 2020

Australian Eastern Standard Time
Sydney NSW (GMT+10)

WEEK 3 - LURE DEVELOPMENT AND APPLICATION

MONDAY 15 JUNE — 11 am - 12 pm

Field evaluation of fruit fly lures in a chemical ecology perspective

Jane Royer

THURSDAY 18 JUNE — 11 am - 12 pm

Roles of semiochemical lures in sexual performance

Dr Kumaran Nagalingam

WEEK 4 - CHEMICAL ECOLOGY OF INSECT-PLANT INTERACTIONS

MONDAY 22 JUNE — 1 pm - 2 pm

Understanding the ecological chemistry of tephritid fruit flies

Dr Kamala Jayanthi

THURSDAY 25 JUNE — 11 am - 12 pm

Perspectives in semiochemical based insect pest management

Dr Dong-Ho Cha

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https://emu.edu/faculty-staff/?show=ms826

Prof. Matthew Siderhurst is a chemical ecologist at Eastern Mennonite University with interests in insect semiochemicals, plant-insect interactions, and applications of these fields to integrated pest management. After his initial introduction to tephritids while postdoc-ing with the USDA in Hilo, HI, Prof. Siderhurst has continued to work on fruit flies with collaborators in Hawaii and Australia. His tephritid research has included the development of several fruit-based attractants, synthesis and testing of novel male lures, and field studies to evaluated trapping for detection and control of pest fruit flies. Outside of research, his interests include frisbee, board games, and books.

Prof. Matthew Siderhurst

Professor

Chemistry Department
Eastern Mennonite University
Harrisonburg, VA (USA)

Chemical ecology perspective: Introduction to the development and application of fruit fly attractants

ABSTRACT

The chemical ecology of tephritid fruit flies includes a diverse group of chemicals that mediate a number of ecological interactions and have proven to be useful in the detection and control of pest species. Tephritid semiochemicals include the so-called male lures (methyl eugenol, cuelure, and trimedlure), fruit lures, protein-associated (food) volatiles, and pheromones. Responses to these semiochemicals vary across tephritid taxa with some species highly attracted to certain lures while others respond only weakly or are considered to be 'non-responsive'. In general, male lures are the most attractive and have been more widely incorporated into detection and control strategies. These strategies include male annihilation, mass trapping, and the use of protein baits. This talk will present an overview of fruit fly chemical ecology structured around three topics, 1) fruit fly semiochemicals, 2) responsiveness of different fly taxa, and 3) detection and control strategies that employ fruit fly semiochemicals.

Monday 8 June

Dr Wei Xu

Senior Lecturer in Entomology

School of Veterinary and Life Sciences
Murdoch University
Perth, WA (Australia)

How do fruit flies smell and taste?

ABSTRACT

Insects live in a world of chemistry. They rely upon smell (the olfactory system) to detect mates, food and oviposition sites. They rely upon taste (the gustatory system) to evaluate which foods to feed on and which foods to avoid. In this presentation, I will talk about fruit fly olfactory and taste systems at the molecular level. I will also dissect how these insects have fine-tuned their chemical sensory systems to sense their environment and regulate their behaviours. Understanding the molecular basis of these mechanisms will provide a vital tool for assessing crucial natural interactions of hosts and insects, as well as allowing us to develop new strategies for fruit fly control through disruption of chemosensory mechanisms.

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Dr Wei Xu received his PhD at the University of California, Davis (UC Davis) in June, 2010. His research project was "Olfactory (Smell) proteins in moths and mosquitoes". Then he came to Australia with an OCE (Office of the Chief Executive) Postdoctoral Fellowship and joined CSIRO Ecosystem Sciences (CES). His study focus is the molecular mechanisms of insect chemosensory systems and their functions in insect-host interaction and co-evolution. From January, 2015, he joined Murdoch University as a lecturer in Entomology. His research interests focus on chemical ecology, functional genomics and molecular biology of agricultural and medical insect species.

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Over the last 35 years or so, Dr Kye-Chung Park has been conducting research on insect chemical communication, identifying pheromones and kairomones and demonstrating species-specific relationship between insects and their hosts through olfactory communication. His research covers the chemical communication of a wide range of insects through his research career in Korea, UK, USA and New Zealand. He has also been trying to use highly developed olfactory sensory system of insects for developing a new biosensor system that can detect low-level volatile compounds. His recent research includes developing attractants for fruit flies and identifying semiochemicals for invasive crane flies in Antarctica.

Dr Kye-Chung Park

Senior Scientist

The New Zealand Institute for Plant and Food Research
Auckland (New Zealand)

Sensory electrophysiology in insect semiochemical research

ABSTRACT

Insects have well developed olfactory sensory system, and the responses of species-specific sets of olfactory receptor neurons (ORNs) can be monitored using various electrophysiological tools such as electroantennogram (EAG) and single sensillum recording (SSR) techniques. GC-EAD, a coupled gas chromatograph-EAG system, has been a powerful tool for semiochemical identification in a number of insects. Using SSR, the response profile of specialized ORNs can be characterised and corresponding active semiochemicals identified. It also provides useful information for us to understand the chemical communication of insects and their hosts. Using electrophysiological tools, we have recently demonstrated that the olfactory sensory roles are very different between the antennae and maxillary palps in two fruit fly species, *Bactrocera depressa* and *B. scutellata*. In this talk, the principle and technical aspects of the sensory electrophysiology for insect semiochemical research will be presented.

Jane Royer

Principal Entomologist

QLD Department of Agriculture and Fisheries (DAF)
Ecosciences Precint, Dutton Park, QLD (Australia)

Field evaluation of fruit fly lures in a chemical ecology perspective

ABSTRACT

For many decades, male fruit fly lures have been one of the most important tools in the monitoring and management of pest species of Dacini (*Bactrocera*, *Dacus* and *Zeugodacus*). Species respond to either cuelure or methyl eugenol, but not both, and many species respond to neither. Identifying new or improved male lures has occurred in several ways, including serendipitous findings, mass laboratory screening, structural modifications of existing compounds and field trials of promising chemicals. While laboratory results may provide a good preliminary indication of a lure's attractiveness, a lure's effectiveness as a field management tool is not truly known until tested in the field. Undertaking such trials requires a good understanding of local fruit fly fauna and an ability to accurately identify catches. I will talk about field trials I have undertaken on novel male lures, key findings and the importance of experience in diagnostics in accurately interpreting results.

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https://www.researchgate.net/profile/Jane_Royer

Jane Royer spent many years working in surveillance, diagnostics and incursion responses for a range of exotic horticultural pests, including fruit flies. More recently, she has worked on research projects on improved lures for Dacini fruit flies in Australia, the Pacific and Asia; fruit fly diagnostics in Australia, (Fruit Fly ID Australia website, Lucid keys and Handbook); fruit fly biogeography and modelling; and delivering workshops in Australia, Indonesia and Malaysia on fruit fly diagnostics and management. Jane also manages the QLD Department of Agriculture and Fisheries' Exotic Fruit Fly Monitoring Laboratory.

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Dr Kumaran Nagalingam is an entomologist and ecologist with a strong interest to advance the basic understanding on insect-plant interactions. Dr Kumaran uses ecological approach, chemical ecology, genomics, transcriptomics and epigenetics approaches to understand complex insect-plant interactions with a view to develop novel management tools. Dr Kumaran studied the influence of cuelure and zingerone on the mating system of the Queensland fruit fly, *Bactrocera tryoni* during his PhD and postdoc research at Queensland University of Technology. In addition to highly novel findings on how male lures influence fruit flies, his work also generated the first publicly available genomic resources for the Queensland fruit fly.

Dr Kumaran Nagalingam

Research Scientist

CSIRO
Ecosciences Precint, Dutton Park, QLD (Australia)

Roles of semiochemical lures in sexual performance

ABSTRACT

Males of many *Bactrocera* species and *Ceratitis capitata* demonstrate strong, positive olfactory and gustatory responses to a number of chemically related phytochemicals such as methyl eugenol, raspberry ketone (cuelure) and zingerone. These plant compounds are commonly involved in sexual selection by increasing male mating success in many *Bactrocera* species although not ubiquitous across all species. The prevailing hypothesis to explain this selection links the male mating success to a more attractive pheromone blend released by males after feeding on phytochemicals. However, mechanisms mediating the male mating success are complex and vary across species. For instance, zingerone changes the genetic expression and energy metabolism of the Queensland fruit fly, *Bactrocera tryoni* that ultimately renders males physically fitter and more competitive in mating. Understanding these mechanisms helps us not only to recognize the role phytochemicals in sexual communication in these fruit flies but also to improve the quality of male flies used in the sterile insect technique programme.

Monday 22 June

Dr Kamala Jayanthi

ICAR-National Fellow & Principal Scientist

Division of Entomology and Nematology
Indian Institute of Horticultural Research
Bangalore (India)

Understanding the ecological chemistry of tephritid fruit flies

ABSTRACT

The tephritid fruit flies with their high genetic diversity, taxonomic complexity and quarantine issues are notorious pests of horticultural crops across the globe. Their interesting odour-mediated eco-behaviours have fascinated entomologists since the time of Howlett. Tephritid fruit flies display complex courtship and oviposition behaviours that separate them cognitively from other insect pests. The current Integrated Pest Management (IPM) programs for tephritids mainly revolve around male annihilation techniques thereby neglecting the females leaving a huge gap in their optimal management. Future application of semiochemicals on tephritid management depends on the availability of the potential cues that enable efficient manipulation of their mate and host-locating behaviours. Detailed studies that shed light on the ecological chemistry of tephritids will aid in understanding their volatile mediated trophic interactions which in turn enables us to pin-point the weak behavioural links that can be exploited for their IPM.

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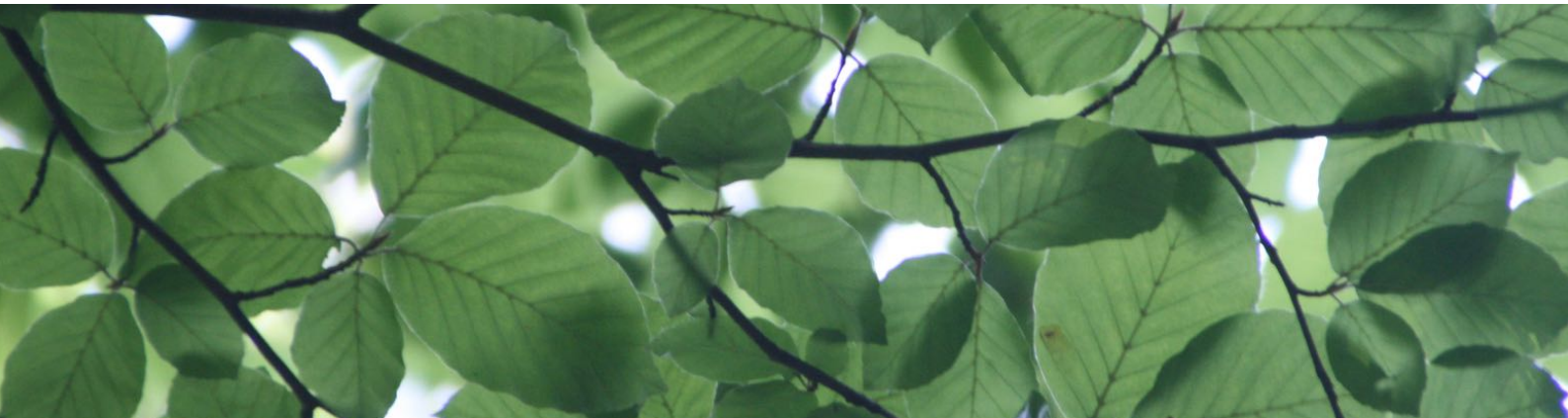
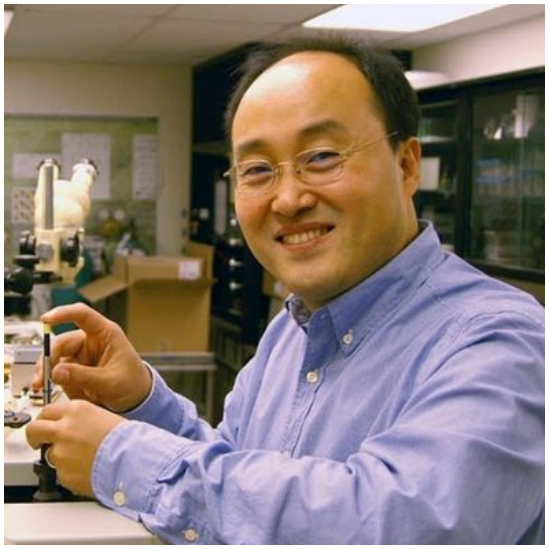
Dr Jayanthi completed her MSc and PhD from ANGR Agricultural University in Hyderabad and did her post-doctoral studies at Kansas State University and Penstate University (USA) and Rothamsted International (UK). Dr Jayanthi's research experience span from mass production, isolation and culturing of microbial agents; genetics of shoot fly (*Atherigona soccata*) resistance in sorghum hybrids; developing IPM modules and forecasting models for different pests of fruit crops; molecular characterisation of fruit fly, *Bactrocera* spp. using nuclear and mitochondrial genes and insect-plant interactions for deciphering potent semiochemical cues to strengthen IPM programs for major horticultural pests. Dr Jayanthi has over 200 research publications, patents and varieties to her credit.





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Dr. Dong Cha is a chemical ecologist and research biologist who has over 15 years of research experience in semiochemical based pest management. He has discovered many novel insect attractant and repellent compounds from insect, plant and microbial sources. His recent work on spotted wing drosophila has led to commercialisation of the attractant and trap in the US and several other countries. His current research focuses on identification of female attractants and contact/special repellents of *Bactrocera* and spotted wing drosophila flies.

Dr Dong-Ho Cha

Research Biologist

United States Department of Agriculture (USDA) - ARS
Hilo, Hawaii (USA)

Perspectives in semiochemical based insect pest management

ABSTRACT

Drosophilid and tephritid fruit flies are among the world's most destructive invasive pests. Frequent use of insecticides is generally necessary for effectively managing these flies. However, reliance on pesticides is costly and risky in terms of resistance development. To develop behaviorally based alternative control methods such as push and pull, I have been interested in identifying chemicals that can attract and repel flies for reduced oviposition on fruit. In this talk, I will discuss approaches and tools involved in the identification process of these behavior modifying chemicals and briefly update on novel attractant and repellent for spotted wing drosophila (*Drosophila suzukii*) and oriental fruit fly (*Bactrocera dorsalis*).

How to join the event

eventbrite

Please register for each session by clicking on this link.

zoom

You will receive detailed instructions on how to join the sessions via email.

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