IPRRG 2025
KUALA LUMPUR, MALAYSIA

Plant pest risks: Challenges and opportunities in a changing world

2025 Annual Meeting of the International Pest Risk Research Group

27-30 October 2025, Kuala Lumpur, Malaysia

PROGRAMME BOOKLET

in association with Cervantes Agritech

IPRRG

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Dear Attendee,

Welcome to the 2025 annual meeting of the International Pest Risk Research Group (IPRRG), held in Kuala Lumpur, Malaysia. This is our first annual meeting held in South-East Asia, which highlights the importance of international capacity building to address the risks of plant pests across the Asia-Pacific region. Globalisation and climate change have significantly increased the risk of plant pest invasions, threatening production and trade networks. Biosecurity capacity-building in climatically vulnerable regions is therefore a key aim of IPRRG, and is reflected in this year's headline, *Plant pest risks: Challenges and opportunities in a changing world*.

Since 2007, IPRRG has connected research scientists, pest risk analysts, and policymakers from around the world to develop and disseminate models, methodologies, maps, and cutting-edge research on key plant pests. The meetings serve as a vehicle to present, discuss, and collaborate on novel modelling approaches and frameworks to address regional and global biosecurity concerns. We also provide webinars throughout the year to continually promote pest risk projects, and have collaborated via the IPRRG network on publications to a broad international audience.

This year, we focus on the following key topics:

- Evolving global plant health and pest risk analysis frameworks
- The risks of fruit flies in the Asia-Pacific region to determine response strategies
- Advances in pest risk analysis modelling tools with interactive workshops
- Bioeconomics
- Spread and impact models of significant plant pests

This meeting would not have been possible without the efforts of Cervantes Agritech. We would like to extend a warm welcome to you, and we look forward to your engagement in sharing your insights and forging valuable international partnerships as part of our shared mission.

Sincerely,

THE INTERNATIONAL PEST RISK RESEARCH GROUP EXECUTIVE COMMITTEE

CHAIR: Conor Francis McGee (Ireland)

VICE-CHAIR & LOCAL ARRANGEMENTS ORGANISER: Jessica Kriticos (Canberra, Australia)

SECRETARY-TREASURER: Ana Clariza Samayoa Castillo (Honduras)

COMMUNICATIONS OFFICER: Ciro Gardi (Italy)

STUDENT REPRESENTATIVE: Helena Romero Marin (Spain)

POLICY LIAISON OFFICER: Alan MacLeod (York, UK)

IMMEDIATE PAST CHAIR: Frank Koch (Research Triangle Park, North Carolina, USA)

PREVIOUS PAST CHAIR & LOCAL ARRANGEMENTS CO-ORGANISER: Darren Kriticos (Canberra, Australia)

IPRRG2025 Meeting Agenda

Members will be informed of any adjustments required to the sessions and presentation order as required.

DAY 1 – 27 October 2025

Location: Palm Gardens Hotel Conference room

09:00 – 09:10 Arrive and register, collect lanyards and IPRRG2026 shirts

09:10 – 09:15 Welcome to the day and announcements (logistics, facilities, amenities) - *Jessica Kriticos*

09:15 – 09:20 Message from the Chair – *Conor Francis McGee*

09:20 – 09:35 History of IPRRG and welcome to IPRRG 2025 – *Darren Kriticos*

09:35 - 09:50 IPRRG's Relationship with IPPC - *Alan MacLeod*

09:50 - 10:05 Brief introductions from meeting participants

In 1 minute or so, tell us who you are, where you are from (location and organisation), and current interest in pest risks

10:05 – 10:15 Meeting expectations: an interactive session

Moderator: Alan MacLeod

10:15 – 10:45 COFFEE BREAK

10:45 - 11:55 Workshop 1: UK Met office degree day modelling tool

https://www.metoffice.gov.uk/hadobs/biosecurity_uk_hist/

Moderator: Alan MacLeod

11:55 – 12:05 Group photo!

12:05 – 13:00 LUNCH

13:00 – 15:00 Technical Session 1: Evolving frameworks for pest risk analysis and surveillance

20 minute talks with 10 minute Q&A

Moderator: Darren Kriticos

13:00	1.1	*The evolution of plant health and pest risk analysis in the EU* Roel Potting, Office for Risk Assessment, Netherlands Food and Product Safety Authority, Utrecht, The Netherlands
13:30	1.2	*Integrating quantitative models in a pest risk analysis framework* Jessica Kriticos, Australian National University / ARC Training Centre in Plant Biosecurity
14:00	1.3	*Tick tock, Pest clock: Time matters in Pest Risk Analysis.* Alan MacLeod, UK Department for Environment, Food and Rural Affairs (DEFRA)

14:30	1.4	*Survey Planning for Emerald Ash Borer (Agrilus planipennis) in Poland* Agata Olejniczak, Instytut Ochrony Roślin – Państwowy Instytut Badawczy (Institute of Plant Protection – National Research Institute), Poznan, Poland

15:00 – 15:20 COFFEE BREAK

15:20 – 16:20 Technical Session 2: Bioeconomics

20 minute talks with 10 minute Q&A

Moderator: Alan MacLeod

15:20	2.1	*Modeling disease expression of Phytophthora ramorum to estimate potential economic impacts in European forests* Stelios Kartakis, Agricultural Economics and Rural Policy Group, Wageningen University, Hollandseweg 1, 6708KN, Wageningen, The Netherlands
15:50	2.2	*Bioeconomic impacts of Coconut Rhinoceros Beetle (Oryctes rhinoceros) under current and future climate scenarios* Darren Kriticos, Cervantes Agritech, Canberra, Australia

16:20 - 16:50 Workshop 2: Pest Risk tool overview

https://pestrisktool.gdlindev8.net/

Moderator: Ultan O'Donnell

16:50 ADJOURN

DAY 2 – 28 October 2025

Location: Palm Gardens Hotel Conference room

08:50 Registrants arrive and settle in with coffee.

09:00 - 11:00 Technical session 3: Advances in modelling tools for pest risk analysis

20 minute talks with 10 minute Q&A

Moderator: Jessica Kriticos

9:00	3.1	*Categorically Uncertain: How Bayesian Belief Networks Help When You're Not Sure What Box to Tick* Alan Macleod, UK Department for Environment, Food and Rural Affairs (DEFRA)
9:30	3.2	*Leveraging AI and Human Expertise in Exotic Pest Early Warning Systems* Godshen Robert, Center for Integrated Pest Management, NC State University, Raleigh, NC, U.S.
10:00	3.3	*Latest advances in CLIMEX and DYMEX software for pest risk analysis and management* Darren Kriticos, Cervantes Agritech
10:30	3.4	*Firmly Rooted: Using host trees to predict new pest invasions* Ultan O'Donnell, Dublin College University

11:00 - 11:30 COFFEE BREAK

11:30 - 12:30 Workshop 2: Pest risk modelling tools

Moderators: Alan Macleod and Darren Kriticos

https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2022.7104

12:30 – 13:30 LUNCH

13:30 – 15:00 Technical Session 4: Risks and adaptations on the fruit fly frontlines

20 minute talks with 10 minute Q&A

Moderator: Darren Kriticos

13:30	4.1	*Assessing the Risk Distribution of Melon Fly for Effective Control Strategies in Taiwan.* Yu Bing Huang, Taiwan Agricultural Research Institute, Taichung, Taiwan, ROC
14:00	4.2	*Economic Impact of Fruit Fly Incursion on New Zealand Kiwifruit Industry* Chandan Pal, Zespri International Limited, Tauranga, New Zealand

14:30	4.3	*Genetic-Ecological Integration for Adaptive Potential Assessment: Case Studies of Two Invasive Bactrocera species.* Yujia Qin, State Key Laboratory of Agricultural and Forestry Biosecurity, MARA Key Lab of Surveillance and Management for Plant Quarantine Pests, College of Plant Protection, China Agricultural University, Beijing

15:00 – 15:30 COFFEE BREAK

15:30-17:00 Workshop 3: Discussion of potential projects to identify collaborative research avenues

Presentation on past IPRRG projects, including Project Stinky and Project X

Recent collaborative research projects have included an EPPO Bulletin series from IPRRG2022, a current CABI project from IPRRG2024, and a NeoBiota special issue

Moderators: Darren Kriticos and Alan Macleod

17:00 ADJOURN

IPRRG Dinner: Zest Restaurant

DAY 3 – 29 October 2025

Location: Kuala Lumpur Butterfly Park and Perdana Botanic Gardens.

Jalan Cenderawasih, Tasik Perdana, 50480 Kuala Lumpur, Wilayah Persekutuan.

08:30 Meet at Palm Garden Hotel reception

08:45 Depart via Grab carpools
09:30 Arrive at Kuala Lumpur Butterfly Park and purchase tickets

10:00 – 11:00 Exploring Kuala Lumpur Butterfly Park

11:00 – 12:00 Hibiscus & Orchid Gardens of Perdana Botanic Gardens

12:00 – 12:30 Stop by the Perdana Eating corner and rest at the Sunken Gardens

12:30 – 13:30 Visit the Perdana Botanic Gardens Deer Park

13:30 – 14:30 Lunch at the Hornbill Café (KL Bird Park)

14:30 – 16:30 Purchase tickets and explore the Kuala Lumpur Bird Park

16:30 Return to Palm Garden Hotel via Grab carpools

DAY 4 – 30 October 2025

Location: Palm Gardens Hotel Conference room

09:00 - 10:30 Technical session 5: Ecology, dispersal, and biology of pests and biocontrol agents

Moderator: Jessica Kriticos

09:00	5.1	*Climate change drives an "ecological stepping-stone" dispersal pattern of a highly destructive invasive pest Colorado potato beetle* Yingxuan Li, China Agricultural University, Beijing
09:30	5.2	*Ecology and Spatial Distribution of the Sugarcane Longhorn Beetle in Northeastern Thailand* Papitchaya (Fin) Teakwul, Department of Entomology, Faculty of Agriculture, Khon Kaen University, Thailand
10:00	5.3	*Feeding capacity and rearing challenges of Toxorhynchites sp. in semi-controlled environments* Ana Clariza Samayoa Castillo, Universidad Nacional Autónoma de Honduras, Facultad de Ciencias, Carrera de Biología. Laboratorio de Entomología Acuática, Tegucigalpa, Francisco Morazán, Honduras.

10:30 -11:00 COFFEE BREAK

11:00 – 12:00 Workshop 4: PRA Under Pressure

Working in groups, participants will explore common challenges in PRA through scenario-based problem solving. Groups will discuss and think critically and collaboratively to develop ideas of how to overcome the challenges.

Moderator: Alan MacLeod

12:00 – 13:00 LUNCH

13:00 – 13:20 Meeting review

Moderator: Alan MacLeod

13:20 – 13:40 Pitches for next meeting and decision

Pitch from Ana Clariza Samayoa Castillo for IPRRG2026 to be held in Honduras.

Pitch from Ultan O'Donnell and Conor Francis McGee for IPRRG2027 to be held in Dublin

Any other pitches from attendees?

13:40 – 14:00 Voting for the best IPRRG presentations

Presentation of IPRRG awards for presentations winners

14:00-15:00 IPRRG Business Meeting

Everyone is welcome to participate in this significant meeting, offering conference participants (now members of IPRRG) a chance to gain insights into the workings of IPRRG, share specific requirements with IPRRG leadership, and contribute to shaping the organization's future direction.

1. Membership status (Darren Kriticos)

2. IPRRG finances (Ana Clariza Samayoa Castillo)
3. Communications issues (Chair / Communications Officer)
4. Student issues (Student Representative)
5. Any other business (AOB)

15:00 ADJOURN AND FAREWELLS

List of abstracts

1.1 The evolution of plant health and pest risk analysis in the EU

Author: Roel Potting, Office for Risk Assessment, Netherlands Food and Product Safety Authority, Utrecht, The Netherlands

Presenting author: r.p.j.potting@nvwa.nl

The European Union (EU) has a long history of dealing with plant pests that threaten its (agro)ecosystems. In contrast to other parts of the world the EU has a very open market for trade in living plants, fruits and vegetables. An overview will be given of the diversity and dynamics of plant trade as well as the number of interceptions and outbreaks. In response to the continuing number of outbreaks the EU has recently strengthened its plant health regulations. The evolution of plant health and pest risk assessment in the EU will be discussed, indicating that the EU is shifting from pest risk assessment to commodity risk assessment. The European Food Safety Authority (EFSA) has been mandated by the European Commission to conduct commodity risk assessments (CRA) of specific imports of high risk plant genera. An overview of the results of these CRA's will be given.

1.2 Integrating quantitative models in a pest risk analysis framework

Author: Jessica Kriticos, Australian National University / ARC Training Centre in Plant Biosecurity

Presenting author: jessica.kriticos@anu.edu.au

To address the ranking of priority plant pests and their preparedness activities in the Australian context, my PhD focuses on developing a pest risk analysis (PRA) framework of four interconnected models and an assessment of preparedness activities. Current global PRA frameworks are impacted by major knowledge gaps, risk-averse biases and a lack of key data, which together reduce the usefulness of qualitative analyses. A quantitative modelling framework for pest risk assessment allows for direct estimates that can be updated with real-world data, maintaining a transparent and generalisable approach.

I am applying a self-organising map to the global pest assemblage to identify which exotic pests are most associated with the national Australian assemblage, explicitly linking distribution to climate tolerances. I will then use Bayesian analysis to assess the arrival rates of high-risk species. This second filter will define which species require a spatial assessment to identify vulnerable areas based on climatic suitability, host availability, and transport networks. I will use four key species from the spatial analysis as case studies for a bioeconomic analysis of potential spread rates and incurred production losses. I will then define what preparedness activities are most likely to be cost-effective.

This research is globally pertinent to address the key uncertainties in pest risk analysis, as a full data-driven modelling pathway from the identification of potentially-risky pests to the identification of appropriate preparedness activities in decision-making.

1.3 Tick tock, Pest clock: Time matters in Pest Risk Analysis.

Author: Alan MacLeod, UK Department for Environment, Food and Rural Affairs (DEFRA)

Presenting author: alan.macleod@defra.gov.uk

Pest risk analysis (PRA) is a critical tool for safeguarding plant health in international trade. Whilst technical and biological aspects of PRA are well established, the temporal dimensions remain under explored. This paper will distinguish between the time frame and the time horizon for PRA and reflect upon how time-related considerations influence each stage of PRA; initiation, risk assessment and risk management. Clearly defining temporal parameters enhances the transparency, consistency, and responsiveness of PRA outcomes. Drawing on recent examples from the UK I will explore whether there is a "Goldilocks time frame" for PRA. This opinion piece contributes to a more nuanced understanding of pest risk in a changing global environment.

1.4 Survey Planning for Emerald Ash Borer (Agrilus planipennis) in Poland

Authors: Agata Olejniczak[1] and Agata-Pruciak Nowak[1]

[1] Instytut Ochrony Roślin – Państwowy Instytut Badawczy (Institute of Plant Protection – National Research Institute), Poznan, Poland

Presenting author: agata.olejniczak@iorpib.poznan.pl

Abstract: *Agrilus planipennis*, commonly known as the emerald ash borer (EAB), is a highly destructive invasive beetle native to Asia. Its harmful impact is more significant in newly colonized areas than in its native range. The main host species for this pest are ash trees (*Fraxinus* spp.), but the beetle also attacks white fringetrees (*Chionanthus virginicus* L.). In the European Union, *Agrilus planipennis* is listed as a Union quarantine pest and as a priority pest under Commission Delegated Regulations (EU): 2019/1702, 2019/1702. Based on Commission Implementing Regulation (EU) 2024/434, each year, Member States are obligated to implement risk-based surveys in areas of their territory where the pest is not known to occur. These surveys should be carried out with an appropriate level of confidence and a suitably low design prevalence, following the EFSA methodology outlined in the Guidelines for statistically sound and risk-based surveys of *Agrilus planipennis*. This approach can be applied using the EFSA tool RiPEST, which was developed for detection, delimiting, and buffer zone surveys.

The first surveys in Poland using the EFSA methodology and RiPEST tool were conducted in 2024. After new outbreaks of *A. planipennis* were reported in Ukraine, the risk areas for survey activities were re-evaluated. Consequently, survey efforts in Poland have been concentrated in areas close to the Ukrainian and Belarusian borders.

One of the main challenges in conducting these surveys is locating suitable host trees, as ash populations have already been significantly reduced due to ash dieback and prolonged periods of drought. Another difficulty in survey planning is the need to precisely define specific parameters such as sampling effectiveness, numbers of inspection units.

2.1 Modeling disease expression of Phytophthora ramorum to estimate potential economic impacts in European forests

Authors: Stelios Kartakis[1], Thomas Jung, Darren J Kriticos[2], Justus Wesseler

[1] Agricultural Economics and Rural Policy Group, Wageningen University, Hollandseweg 1, 6708KN, Wageningen, The Netherlands

[2] Cervantes Agritech, Canberra, Australia

Presenting author: stelios.kartakis@wur.nl

Phytophthora ramorum is an invasive generalist plant pathogen introduced to North America and Europe in the mid-1990s, now established in forests and the nursery industry. It causes Sudden Oak Death in the western US and Sudden Larch Death in Europe, leading to extensive forest decline. While well studied in California and Oregon, no quantitative assessment exists for its potential economic impact on European forestry. We assessed the potential direct economic impact of *P. ramorum* on larch (*Larix* spp.) and beech (*Fagus* spp.) in Europe under a "no-control" scenario. Climatically optimal areas for disease expression were obtained using the CLIMEX niche model with refined parameter values, updated climate data, and *P. ramorum* occurrence records derived solely from symptomatic trees. These areas were overlaid with host distribution data to identify assets at risk. We used a radial range expansion model and a partial budgeting approach to quantify the annualized average damage costs. Our results indicate that 10.1% of the study area is climatically optimal for disease expression. Within that area, 4,223 km² of larch and 2,577 km² of beech are at risk. Under worst-case spread and mortality assumptions, annual direct damage costs could exceed €16 million for larch and €112 million for beech. Countries such as the UK, Italy, Austria, and Germany bear the highest risks, while impacts in southern Member States are negligible. This study provides an updated risk assessment for the current post-invasion state of *P. ramorum* in Europe, facilitating informed decision-making and appropriate management strategies.

2.2 Bioeconomic impacts of Coconut Rhinoceros Beetle (Oryctes rhinoceros) under current and future climate scenarios

Authors: Ethan Tay[1], Darren Kriticos[2], Noboru Ota[3], Rahul Rane[3], Wee Tek Tay[3]

[1] Australian National University

[2] Cervantes Agritech, Canberra, Australia

[3] CSIRO

Presenting author: darren@cervantesagritech.com

The coconut rhinoceros beetle (*Oryctes rhinoceros*) is arguably the highest priority agricultural/biosecurity threat facing Pacific Island nations. Native to south and east Asia, it attacks palm trees, which are an important economic resource in the Pacific, as well as a cultural centrepiece, food staple, natural construction material source and ecological keystone species in these regions. The Adult beetles attack the palm fronds before boring into the crowns of trees, laying eggs in composts and green wastes. Given the social and environmental importance of *O. rhinoceros* and the socio-economic capacity of Pacific Island Nations, there is a strong role for aid donors to help address the problems. To inform donor decision-making regarding investments in impact management activities such as plant breeding, biological control, and slow the spread campaigns, it is important to understand the potential economic impacts of *O. rhinoceros.* In this study we combine a CLIMEX model

with production statistics and damage reports to estimate economic costs of O. rhinoceros on the major host crops *C. nucifera* (coconut palm) and *E. guineensis* (African oil palm).

3.1 Categorically Uncertain: How Bayesian Belief Networks Help When You're Not Sure What Box to Tick

Authors: Alan Macleod[1], Willem Roelofs

[1] UK Department for Environment, Food and Rural Affairs (DEFRA)

Presenting author: alan.macleod@defra.gov.uk

A variety of approaches support decision-making in assessing risk from plant pests and invasive species. Qualitative and quantitative protocols often use structured questions with categorical or scored responses, which are combined to produce an overall risk category or score. While these scores can rank species by risk, most methods struggle to address uncertainty in assessor responses. This presentation revisits a novel application of a Bayesian belief network (BBN) to assess plant pest risks. BBNs are probabilistic models that represent variables and their conditional relationships, offering a transparent and consistent framework for combining risk elements. They are particularly valuable for handling uncertainty, allowing assessors to distribute belief across multiple response categories rather than selecting a single one. This enhances transparency by explicitly showing how each input influences overall risk. The approach also identifies knowledge gaps and areas of high uncertainty, helping to guide future research. Results from example pest risk assessments demonstrate the utility of BBNs not only in evaluating pest risk but also in illustrating the potential effectiveness of phytosanitary measures. The presentation will discuss whether the BBN framework improves clarity, consistency, and robustness in pest risk analysis.

3.2 Leveraging AI and Human Expertise in Exotic Pest Early Warning Systems

Authors: Godshen Robert[1], Dalon White[2], Micheal Cunanan[2]

[1] Center for Integrated Pest Management, NC State University, Raleigh, NC, U.S.

[2] USDA APHIS Plant Protection Quarantine

Presenting Author: godshenrobert@ncsu.edu

Two complementary surveillance initiatives, PestLens and the in-development Automated Information Retrieval and Analysis (AIRA) system, are expanding how plant biosecurity identifies and evaluates emerging pest signals from outside the United States. PestLens provides human-curated surveillance by screening approximately 400 journals each week across entomology, plant pathology, nematology, and weed science, producing concise, source-linked articles on new pests, hosts, geographies, and diagnostic methods. After each release, an internal working group determines whether to update the national pest knowledge base and whether new reports change introduction likelihood along existing trade pathways.

AIRA, currently in development, is being designed to extend coverage to web-native sources such as IPPC and RPPO reports and databases, social media, and citizen-science platforms (e.g., GBIF, iNaturalist), as well as internal secure PDF repositories. Restricted/internal documents will be processed on-premises with local (open-source) LLMs to keep data in-house, while publicly available content may be routed to more powerful closed models (e.g., GPT, Claude, Gemini) for scale and speed. Prototypes use retrieval-augmented generation (RAG) pipelines with chunking strategies optimized for processing at context windows allowed by the models, enabling large language models to extract new host and new pest–location information accurately from diverse formats. Outputs are reviewed by subject-matter experts, and guardrails are being developed to minimize hallucinations and ensure

reproducibility. Together, PestLens and AIRA aim to deliver faster, more reliable intelligence for incorporation into national pest risk analysis and response.

3.3 Latest advances in CLIMEX and DYMEX software for pest risk analysis and management

Authors: Darren Kriticos[1], Tania Yonow[1], Lauren Glina[1], Jessica Kriticos[1]

[1] Cervantes Agritech, Canberra, Australia

Presenting author: darren@cervantesagritech.com

CLIMEX and DYMEX continue to be developed to improve user-friendliness and applicability for pest risk analysis and pest management applications. In this presentation we will demonstrate some of the new features such as automated simulations of composite irrigation scenarios. The continued expansion of irrigation is significantly affecting the patterns of pest risk and invasion pathways. While CLIMEX has always been able to run irrigation simulations, without restricting the simulations to areas equipped for irrigation massively overestimated the pest risk area. Previously, creating spatially-explicit irrigation scenarios required specialist GIS techniques to combine natural rainfall and irrigation scenarios into a composite mapping product. CLIMEX now includes a powerful spatial manipulation tool that will underpin a new wave of enhancements. CLIMEX and DYMEX now include the ability to read and write NetCDF files. DYMEX is now being used at the heart of real-time pest risk modelling and forecasting systems with government and commercial applications centred on interactive webmapping systems. Using the CLIMEX and DYMEX platforms creates an efficient means of transforming research models into useful and valuable information products to inform pest managment.

3.4 Firmly Rooted: Using host trees to predict new pest invasions

Authors: Ultan O'Donnell[1], Conor F McGee[2], Andy Bourke[2], Jon M Yearsley[1]

[1] Dublin College University, Ireland

[2] Department of Agriculture, Food and the Marine, Ireland

Presenting author: ultan.odonnell@ucdconnect.ie

Sustainable forestry management and the ecosystem services that forestry provides are at increasing risk from the invasion of non-native forest pests. Identifying which invasive species pose the greatest risk of establishment would help provide an evidence base to streamline risk assessment and appropriately allocate detection and management resources. However, there is often not enough location data to describe the niche where these pests occur currently, limiting our ability to quantify risk and prioritise potential pests. To address this, we developed and tested a novel quantitative approach using host tree location data in lieu of pest data to develop Species Distribution Models (SDMs) to describe the potential niche of each pest, ranking their relative risk of establishment. This method was applied to oak and pine forestry pests in the EPPO global database to identify their establishment risk to Ireland and Sweden under current and future climate conditions, and validated using independent pest data. Relative risk of establishment was then ranked to identify potential pests for each study area, presenting a list of pests that should be considered for further evaluation for risks of introduction and impact. Our methodology of modelling host habitat niches is effective at ranking the relative risk of pests, identifying opportunities for risk prioritisation where pest data is incomplete.

4.1 Assessing the Risk Distribution of Melon Fly for Effective Control Strategies in Taiwan.

Author: Yu Bing Huang, Taiwan Agricultural Research Institute, Taichung, Taiwan, ROC

Presenting author: ybhuang@tari.gov.tw

The melon fly (Zeugodacus cucurbitae) is a destructive pest of cucurbit crops and poses a significant threat to vegetable production in Taiwan. Its high reproductive capacity and ability to adapt to diverse environments have facilitated frequent outbreaks, leading to considerable economic losses. This study assesses the spatial risk distribution of the melon fly in Taiwan using the CLIMEX modeling framework. Occurrence records were integrated with key climatic variables to predict current and potential distribution patterns. Geographic Information System (GIS) analyses were further applied to generate risk maps and identify high-vulnerability regions. The results indicate that southern and eastern Taiwan provide highly suitable conditions for melon fly with potential expansion under projected climate change scenarios. These findings enhance the understanding of the ecological niche of melon fly in Taiwan and provide a scientific basis for strengthening surveillance, quarantine regulations, and area-wide integrated pest management (AW-IPM) strategies targeting cucurbit crops

4.2 Economic Impact of Fruit Fly Incursion on New Zealand Kiwifruit Industry

Authors: Ruth Underwood[1], Warren Hughes[2], Rebecca Burns[3], Jessie Fea[3], Matt Dyck[4], Chandan Pal[3]

[1] Fruition Horticulture (BOP), Tauranga, New Zealand

[2] Hughes Economics, Auckland, New Zealand

[3] Zespri International Limited, Mount Maunganui, New Zealand

[4] Kiwifruit Vine Health (KVH), Mount Maunganui, New Zealand

Presenting author: chandan.pal@zespri.com

Fruit flies are among the most destructive pests globally and pose a significant biosecurity threat to New Zealand's $8.5 billion horticulture sector. New Zealand's status as one of the few countries free from economically significant fruit flies, like the Queensland Fruit Fly and Mediterranean Fruit Fly, gives its growers access to premium export markets. However, habitat and climate modelling show that these pests could establish in many North Island areas and persist during summer. Since 1989, fruit flies have been detected post-border in New Zealand 13 times. These incursions triggered four major biosecurity responses, most recently for the Queensland fruit fly in 2015 and 2019, and the Oriental fruit fly in 2025. Although these biosecurity incursions were successfully contained, they caused immediate export restrictions from affected regions. The New Zealand kiwifruit industry, which earned $3.1 billion in 2024, could be significantly impacted by a fruit fly incursion in the Bay of Plenty region that supplies 25-30% of the world’s kiwifruit trade. We modelled three incursion scenarios (base, medium, and large) and estimated a single-season economic impact ranging from nearly $200 million in the base scenario to almost $700 million in the large scenario. Our analysis found that implementing cold disinfestation treatment could reduce these impacts by 30-40% by helping maintain market access. This work highlights the importance of early detection to limit the economic damage of a fruit fly incursion on the kiwifruit industry and shows how risk modelling can support proactive decision-making for better market access and fruit export.

4.3 Genetic-Ecological Integration for Adaptive Potential Assessment: Case Studies of Two Invasive Bactrocera species.

Authors: Yujia Qin[1], Zhang Yuan, Li Zhihong

[1] State Key Laboratory of Agricultural and Forestry Biosecurity, MARA Key Lab of Surveillance and Management for Plant Quarantine Pests, College of Plant Protection, China Agricultural University, Beijing

Presenting author: qinyujia@cau.edu.cn

Most global warming is attributed to increased human activities, and this warming is likely to reshape how we perceive and manage nonnative invasive species. Species distribution models (SDMs) are widely used to assess invasion risks; however, they may underestimate threat levels because they do not account for drivers of local adaptation and evolutionary mechanisms that influence species' responses to environmental change. To address this limitation, we developed an integrative and scalable framework that combines population genomics with climate niche modeling, supported by an RGB visualization approach, to improve the accuracy and resolution of invasion risk forecasts. We tested this framework on two invasive fruit fly species with contrasting distribution ranges: Bactrocera tsuneonis (restricted) and Bactrocera dorsalis (widespread). Using whole-genome resequencing data, we found that human-mediated dispersal has played a central role in their invasion history. Genotype–environment association (GEA) analyses identified candidate genes associated with climatic adaptation. Gradient forest models were then applied to quantify local, forward, and reverse genetic offsets, while SDMs were used to project current and future climatic suitability. Genomic offset analyses, together with SDM projections, were used to assess adaptive potential under climate change. Our results identify the most robust adaptation areas worldwide and reveal potential future migration directions. These findings demonstrate the value of combining genomic and ecological data. By integrating genomic signals with climatic suitability, our framework captures adaptive capacity patterns that conventional SDMs alone may overlook, enabling more precise identification of high-risk regions and migration direction. This integrative approach provides a powerful tool for improving global risk assessments of biological invasions.

5.1 Climate change drives an "ecological stepping-stone" dispersal pattern of a highly destructive invasive pest Colorado potato beetle

Authors: Yingzuan Li[1], Yujia Qin[2], Zhang Yuan[1], Li Zhihong[1]

[1] China Agricultural University, Beijing

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Climate change is driving the distribution and spread of invasive species, posing a significant threat to global agricultural health. Therefore, effective management of invasive species spread is crucial. By integrating species distribution model Biomod2 and Linkage Mapper, the potential diffusion habitat corridors of Colorado potato beetle (CPB), were identified via its host Solanum rostratum (SR). The predicted potential distribution of CPB was used as the source layer, whereas the potential distribution of SR combined with elevation data constituted the resistance surface. The results indicated that CPB has broad suitable habitats in China. Under climate change, suitable areas are projected to shift northward and westward, with an overall reduction in suitable habitat area expected, especially in low-latitude southern regions. Under current climate conditions, 33 dispersal corridors were identified, spanning all major potato-producing areas in China. Existing CPB populations in Xinjiang and Northeast China may expand southward along these routes. Corridors in the northern single-cropping potato region exhibit high dispersal potential for CPB Hexi Corridor emerged as a critical dispersal pathway. More corridors were predicted under future scenarios, mainly in western China, with high-intensity flows in the Hexi Corridor and Hami region of Xinjiang. These findings highlight the Hexi Corridor as key areas were needed to be intensified monitoring to mitigate southward spread of CPB. This study provides a scientific basis for predicting and managing the spread of CPB and offers important insights for the prevention and control of invasive species.

5.2 Ecology and Spatial Distribution of the Sugarcane Longhorn Beetle in Northeastern Thailand

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The sugarcane longhorn beetle (Dorysthenes spp.) causes widespread damage in Thailand's sugarcane plantations. However, critical gaps in our understanding of its ecology and distribution lead to inefficient management. This study aimed to examine the pest's ecology and model its current and future distribution using the MaxEnt model. Field trials were carried out between September 2024 and August 2025. The results revealed an age-related habitat shift, with early-stage larvae (L1-L3) inhabiting the root zone and late-stage larvae (L4-L10) boring into cane stalks. According to the distribution, under the current climate scenario, high suitability areas are concentrated in the Northeastern region, where suitable areas were found in provinces including Chaiyaphum, Khon Kaen, Nong Bua Lamphu, and Nakhon Ratchasima. In future climate scenarios, the suitable habitat areas for this species show an expansion trend, which increases over time. The species has high demands for precipitation and can adapt to future climate warming. Management can be optimized through a data-driven strategy that combines targeted monitoring in high-risk provinces with stage-specific pest control.

5.3 Feeding capacity and rearing challenges of Toxorhynchites sp. in semi-controlled environments

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Species of the Toxorhynchites genus have been used as biological control agents to reduce mosquito larval populations. Our objective was to establish a Toxorhynchites colony under semi-controlled environmental conditions and to evaluate their potential as biological control agents. Toxorhynchites sp. eggs were collected from discarded tires used as larvitraps and individually placed in 12 oz cups. After five days, larvae were fed daily with different developmental stages of mosquito larvae, and the number of larvae consumed was recorded. Adults were maintained in modified cages and fed with a sugar–water solution until death. Our results showed that Toxorhynchites sp. larvae can consume up to 2,000 mosquito larvae during their development. However, adults may require larger cages, as individuals died without laying eggs. These findings suggest that further research is needed to develop methods that allow successful mating and oviposition, in order to establish sustainable colonies and promote the use of Toxorhynchites as effective biological control agents.