12th Annual Meeting
International Pest Risk Research Group
16 – 19 October 2018
Taichung, Taiwan

Hosted by the Taiwan Agricultural Research Institute
and National Chung Hsing University

Dear Attendee,

Welcome to the twelfth annual meeting of the International Pest Risk Research Group. We move to Taichung, Taiwan after a very successful program last year in Ottawa, Canada. The theme of our meeting this year is "Burgeoning Asian Trade Connectivity: Implications for International Pest Risks." Throughout Asia, new trade partnerships and rapid expansion of infrastructure will have dramatic effects on the global movement of agricultural products and other goods. The economic opportunities provided by such developments will, in turn, bring new and different invasive species risks. This year we wish to focus attention on this shifting risk landscape to better understand and prepare for the emerging challenges. We look forward to the opportunity to discuss efforts to improve and apply fundamental information, analytical methods, and uncertainty treatments for pest risk analysis.

This meeting would not have been possible without the efforts of Taiwan Agricultural Research Institute and National Chung Hsing University as well as the Local Organizing Committee (chaired by Dr. Shaw-Yhi Hwang and Dr. Yu-Bing Huang). They have been responsible for all local arrangements. We thank them all! We are also extremely grateful to the Taiwan Ministry of Science and Technology (MOST) for their sponsorship of this meeting.

We hope you have a thought-provoking time in Taichung, Taiwan!

Kindly,

Chair: Prof. Darren Kriticos (CSIRO, Australia)
Vice-Chair: Dr. Denys Yemshanov (Natural Resources Canada, Canadian Forest Service, Canada)
Secretary-Treasurer: Dr. Senait Senay (University of Minnesota, USA)
Communications Officer: Dr. Frank Koch (USDA Forest Service, USA)
Student Representative: Dr. Ana Clariza Samayoa (National Chung Hsing University, Taiwan)
Local Organizing Committee: Dr. Shaw-Yhi Hwang (National Chung Hsing University, Taiwan) & Dr. Yu-Bing Huang (Taiwan Agricultural Research Institute)

Day 1 – Tuesday, October 16, 2018

Morning location: NCHU Agriculture and Environmental Science Building, 7th Floor, Rm. 7D09
Afternoon location: NCHU International Agriculture Center, 2nd Floor

Introduction to the meeting (Moderator: Frank Koch)

8:40 Welcome to IPRRG 2018 – Darren Kriticos and Denys Yemshanov

8:50 Welcome to Taichung and National Chung Hsing University – Deputy Dean/ Prof. Shaw-Yhi Hwang

9:10 History of IPRRG: Accomplishments and intentions – Darren Kriticos

9:30 Brief introductions from meeting participants (*In 30 seconds or less, who are you, where are you from, for whom do you work, and why are you interested in this meeting?*)

9:50 Break

Impact Assessment (Moderator: Darren Kriticos)

10:20 (1) Pest risk assessment and plant quarantine policy in Taiwan – Chun-Nan Chou, Hui-Wen Weng, Tzu-Yi Weng & Tse-Wei Chen

10:40 (2) Estimating the monetary value generated by Australia's biosecurity 'system' - Aaron J. Dodd & Tom F. Kompas

11:00 (3) Where the (urban) palms are: potential impact of a palm pest on the US mainland - Frank H. Koch, Mark J. Ambrose, F.D. Cowett, Alan Burnie & Olya Rysin

11:20 (4) Developing a methodology to prioritize EU plant pests based on socio-economic and environmental impacts: the Impact Indicator of Quarantine Pests (IIQP) - Berta Sanchez, Jesus Barreiro-Hurle, Emilio Rodriguez-Cerezo, Iria Soto-Embodos & Mihaly Himics

11:40 Discussion of morning presentations

12:00 Group photo! ☺

12:15 Lunch (Students-Please meet with Ana Clariza Samayoa for a small gathering and networking opportunity.)

Pest Risk Analysis in Practice (Moderator: Denys Yemshanov)

2:00 (5) A quantitative assessment of the likelihood of *Spodoptera frugiperda* entering the EU at a sub-national spatial scale, and the effect of mitigation measures - Alan MacLeod, Roger Day, Regan Early, Ciro Gardi, Allan Hruska, Olaf Mosbach-Schulz, Rodney Nagoshi & Wopke van der Werf

2:20 (6) When they've already made up their mind: providing better advice in the real world - Melanie J. Newfield

2:40 (7) Which risk assessment for decision-makers? – Helen M. Harman

3:00 Break

Climate Change and Pest Risk I (Moderator: Darren Kriticos)

3:30 (8) The impact of climate change on the potential geographic distribution and population occurrence of the tomato fruit worm (*Helicoverpa armigera*) - Yu-Bing Huang, Ming-Yaw

Chiang & Chia-Yin Ku

3:50 (9) Estimating the pest impact under climate change: Elevated temperature and CO_2 condition reduce performance of *Spodoptera litura* F. due to reducing the nutrition value and secondary compounds on foliage of *Rorippa dubia* Persoon. - Tuan Pham Anh, Teawkul Papitchaya & Hwang, Shaw-Yhi

4:10 (10) Elevated CO_2 may alter pheromonal communication in *Helicoverpa armigera* - Kyungsan Choi, Seung-Joon Ahn, Su Bin Kim, Jeong Joon Ahn, Bong Nam Jung, Sang Wook Go & Dong-Soon Kim

4:30 Discussion of afternoon presentations

5:00 Adjourn for day

Day 2 – Wednesday, October 17, 2018

Location: NCHU International Agriculture Center, 2nd Floor

8:50 Welcome to the day

Inspections and surveillance (Moderator: Alan MacLeod)

9:10 (11) Proportional allocation of inspection resources to heterogeneous strata delivers nominal sensitivity: contradicting an international regulatory standard - Andrew Robinson, Steve Lane, Robert Cannon & Tony Arthur

9:30 (12) Optimal surveillance of biological invasions: comparing risk-based and acceptance sampling approaches – Denys Yemshanov, Robert G. Haight, Cuicui Chen, Ning Liu, Cristian MacQuarrie, Robert Venette, Frank H. Koch & Krista Ryall

9:50 (13) Modelling to predict risks and assess control options for emerging and invasive forest pests - Wopke van der Werf, Bob Douma, Monique Mourits & Christelle Robinet

10:10 (14) Spatial dispersion pattern and development of a sequential sampling plan for the Asian citrus psyllid (Hemiptera: Liviidae) in Mexico - Gabriel Díaz Padilla, José I. Lopez Arroyo, Rafael A. Guajardo Panes & Ignacio Sánchez Cohén

10:30 Break

11:00 Discussion of morning presentations

11:30 Discussion of workgroup goals for the meeting – Darren Kriticos and Frank Koch

12:00 Working lunch; **short talks on posters** and interaction with poster presenters. Short talks provide an opportunity for poster presenters to say a few words about their work to the group. "Short talks" are meant to be less than 5 minutes. They are completely optional but are encouraged.

Modelling and Mapping Potential Distribution (Moderator: Ana Clariza Samayoa)

1:40 (15) The potential global distribution of *Spodoptera frugiperda sensu lato*: sensitivity to climate change and climate variability - Darren J. Kriticos, Hannalene Du Plessis, Johnnie Van den Berg & Noboru Ota

2:00 ~~(16) Mapping the global distribution and potential threatened areas of the papaya mealybug (*Paracoccus marginatus*), using ecological niche models (ENM) and spatial~~

~~analysis to assist pest risk assessments - Beatriz Vanessa Herrera Campo, Kris A. Wyckhuys, Marian Koch & Reimund P. Rötter~~

2:20 (17) Why are plant pathogens under-represented in eco-climatic niche modelling? - Kylie B. Ireland & Darren J. Kriticos

2:40 Discussion of modelling and mapping presentations

3:00 Break

Climate Change and Pest Risk II (Moderator: Darren Kriticos)

3:30 (18) Warming impact on pest population composition improves biocontrol effectiveness – Ying-Jie Wang, Takefumi Nakazawa & Chuan-Kai Ho

3:50 (19) Impacts of elevated temperature and CO_2 concentration on plant-insect interactions in subtropical regions - Papitchaya Teawkul, Shaw-Yi Hwang & Anh-Tuan Pham

4:10 (20) Effect of sowing dates, climatic variables on major insect pest populations and host plant resistance to pod borer *Helicoverpa armigera* (Hubner) in pigeonpea (*Cajanus cajan* (L.) Millsp.) - Jagdish Jaba, Sumith Vashisth, Suraj Mishra & Hari Chand Sharma

4:30 (21) Effect of changing weather variables on the outbreak of legume diseases – Mamta Sharma, S. G. Ramanagouda, Raju Ghosh & Amrendar Jha

4:50 Discussion of afternoon presentations

5:10 Adjourn

Day 3 – Thursday, October 18, 2018

Location: NCHU International Agriculture Center, 2nd Floor

8:30 Welcome to the day

Population, Spread, and Pathway Models (Moderator: Frank Koch)

8:40 (22) Population dynamics model to explore waste management areas in Taiwan, using black soldier fly *Hermetia illucens* (Diptera: Stratiomyidae) - Ana C. Samayoa, Darren J. Kriticos & Shaw-Yhi Hwang

9:00 (23) Molecular diversity of rice leaffolder (*Cnaphalocrocis medinalis* Guenée) in Taiwan - Tzu-Wei Guo, Dai-Rong Wu, Chung-Ta Liao, Chia-Hung Hsieh & Wen-Po Chuang

9:20 ~~(24) Invasion dynamics and potential spread of the invasive alien plant species *Flaveria bidentis* (Asteraceae) in China – Rui Wang, Zhixin Zheng & Fanghao Wan~~

9:40 Discussion of morning presentations

10:00 Break

Towards better assessment of risk in EPPO region (Moderator: Darren Kriticos)

10:30 (25) Regulated non-quarantine pests: towards a wider and better application of this international concept in the EPPO region – Camille Picard & Martin Ward

10:50 (26) A new EPPO platform for sharing information on planned and completed PRAs – Muriel Suffert, Damien Griessinger & Camille Picard

11:20 Break to prepare for technical excursion. Comfortable clothing, walking shoes and an umbrella are recommended

Technical excursion with lunch (all times are approximate)

11:30 - Bus to Sun Moon Lake -1:30 (1.5 hours)

Technical excursion (site visit and discussion)

1:00 - 2:30 Depart to Tea Research and Extension Station

3:00 - 4:30 Boat tour
4:30 - 5:30 Site visit and discussions around Sun Moon Lake
5:30 - Return to Taichung

7:00 Group Dinner – At the Park City Hotel

Day 4 – Friday, October 19, 2018

Location: NCHU International Agriculture Center, 2nd Floor

8:30 *Brainstorming session (Moderators: Darren Kriticos and Frank Koch)*

Discuss and prioritize critical issues regarding the international pest risks arising from increasing trade connectivity within Asia and between Asia and the rest of the world. Outcomes of the session can form the basis for a technical peer reviewed paper.

- New trade agreements increase trade connectivity that heightens pest invasion risks
- New commodity and transport pathways introduce new pest arrival risks
- Reduced travel time increases the pest survival
- Countries have differential capacity to assess and manage pest risks associated with imports and exports
- Increasing trade volumes may overwhelm biosecurity systems based on manual inspection / assessment technologies
- Increased need for novel tools and solutions to solving pest risk management problems

10:00 Break

IPPRG Business Meeting

10:30 *Past, present, and future of IPRRG: getting down to business.* All are invited to attend this important meeting, which provides an opportunity for members to understand the operations of IPRRG, to inform IPRRG leaders of specific needs, and to help shape the direction of the organization. (Please consult the handout for critical information)

1. What will we accomplish in this meeting? (Chair)
2. IPRRG membership status report (Secretary-Treasurer)
3. IPRRG finances / balance sheet (Secretary-Treasurer)
4. Communications issues (Communications Officer)
5. Student issues (Student Representative)

6. When and where is our next get-together? (Chair / Vice Chair)
   a. Host nominations and proposals for IPPRG 2020 and beyond (open to any IPRRG member)
   b. Discussion of host nominations / proposals
7. Is there anything else we haven't covered?

11:50 Meeting wrap-up

- Presentation of IPPRG 2018 award winners

12:00 Adjourn

Posters:

~~**The damage fluctuation of strawberry pest in the field.** Hung Ju Chen, Dao Yuan Xue & Yi Yuan Chuang~~

A plant health risk assessment toolbox "wishlist". Martin Damus

Campus Map: National Chung Hsing University

Map of the Campus

01. Humanities Building
02. Language Center
03. President's Residence (Ying-Lu)
04. Coniferous Tree Area
05. Security Office
06. Main Entrance
07. Hui-Sun Auditorium
08. Student Center
09. Small Auditorium
10. International Agriculture Center
11. Women's Dormitory (Chin Hsuan)
12. Women's Dormitory (Pu Hsuan)
13. Women's Dormitory (Hua Hsuan)
14. Faculty Housing
15. Women's Dormitory (Yi Hsuan)
16. Post Office
17. Faculty Housing
18. Integrated Teaching Building
19. Nan Garden
20. Administration Building
21. Chemical & Material Engineering Building
22. Electrical Engineering Building
23. Life Science Building
24. Applied Science & Technology Building
25. Science & Engineering Building
26. Forestry Building
27. Water & Soil Conservation Building
28. Water & Soil Conservation Building 2A
29. Applied Economics Building 2A
30. Graduate Institute of Biotechnology
31. Food Science & Biotechnology Building
32. Food Science & Biotechnology Processing Plant
33. Animal & Plant Health Inspection Building
34. Social Science & Management Building
35. Chung-Hsing Lake
36. Agricultural & Environmental Science Building
37. Precision Engineering Building
38. Horticultural Experiment Station
39. Plant Science Building
40. Information Science Building
41. Chemistry Building
42. College of Science Building
43. Applied Economics Building 1A
44. Tennis Court
45. Civil & Environmental Engineering Building
46. Men's Dormitory
47. Yun-Ping Building
48. Library
49-50. Green House
51. Mechanical Engineering Building
52. Machinery Workshop
53. Innovation Incubator
54. Bio-Industrial Mechatronics Engineering Building
55. Mechanical Engineering Building 2A
56. Concrete Technology Building
57. Men's Dormitory (Jen Chai)
58. Men's Dormitory (Yi Chai)
59. Men's Dormitory (Li Chai)
60. Men's Dormitory (Chih Chai)
61. Men's Dormitory (Hsin Chai)
62. Dormitory Mail Room
63. Sports Field
64. Basketball Court
65. Volleyball Court
66. Tennis Court
67. Gymnasium
68. Crop Science Laboratory
69. Indoor Swimming Pool
70. Animal Experiment Center
71. Experimental Farm for Agronomy Department
72. Large Animal Facilities
73. Animal Science Building
74. Veterinary Medicine Building
75. Animal Disease Diagnostic Center
76. Veterinary Medical Teaching Hospital

Abstracts to Oral Presentations

(Arranged in order of presentation)

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(1) Pest risk assessment and plant quarantine policy in Taiwan

Chou, Chun-Nan[1], Wang, Hui-Wen[1*], Wang, Yi-Tzu[1], Chen, Tse-Wei[1*]

[1]Centre Plant Quarantine Division, Bureau of Animal and Plant Health Inspection and Quarantine, Taiwan; [*]presenting author

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Due to the increased frequency and new modes of international transport of agricultural products, the risks for introduction of exotic plant pests and weeds are increasing. In order to protect the safety of Taiwan's agriculture and to facilitate trade, the Bureau of Animal and Plant Health Inspection and Quarantine (BAPHIQ) performs pest risk assessments (PRAs) as a necessary step for the development of phytosanitary requirements for imports. The PRA process is in accordance with scientific evidence and international standards such as the World Trade Organisation's SPS Agreement, the International Plant Protection Convention (IPPC) and relevant International Standards for Phytosanitary Measures (ISPMs). To facilitate the export of Taiwan's agricultural products, BAPHIQ is also responsible for providing science-based information to importing countries in keeping with their level of protection and requirements for import risk analysis. To establish a sound system of plant quarantine in order to effectively control important plant diseases and pests, and mitigate risks of invasion, BAPHIQ has created and implemented the following policies: (1) Enhance Taiwan's regulatory framework; (2) Reinforce import quarantine rules and standards; (3) Facilitate the safe export of agricultural products; (4) Support research for plant quarantine; (5) Promote the professional development of personnel; (6) Participate in international activities and cooperation; (7) Enhance risk communication and public awareness; and (8) Strengthen partnerships with industries and agencies.

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(2) Estimating the monetary value generated by Australia's biosecurity system

Dodd, Aaron J.[1*], Kompas, Tom F.[1]

[1]Centre of Excellence for Biosecurity Risk Analysis, School of Biosciences, The University of Melbourne, Victoria, Australia; [*]presenting author

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Biosecurity is a risk-based pursuit. Regulators are charged with maximising the benefits of burgeoning trade connectivity whilst simultaneously minimising the risk that harmful pests and diseases are introduced in the process. The prevailing paradigm is that a well-designed set of biosecurity interventions will yield large positive benefits, however, this contention is almost completely untested at the system-scale. Research into the relative effectiveness of risk-reduction measures typically evaluate either multiple interventions targeting a single pest or, conversely, a single intervention targeting multiple pests – only a handful of analyses have examined the potential effectiveness of

multiple interventions simultaneously targeting multiple pests, as they do in practice. Consequently, it is unclear exactly how much monetary 'value' one could expect to be generated by a comprehensive biosecurity system, such as Australia's. Without a clear understanding of the net benefits obtained from the existing investment in biosecurity activities it is difficult to determine the extent to which the system is achieving its desired objectives (its 'health') and also whether there is scope to increase either the value or health of the system by altering the allocation of resources. In this presentation we will present an update on our progress towards estimating the value generated by Australia's biosecurity system and discuss the challenges faced by the team as part of this complex and ambitious project. Burgeoning Asian trade connectivity: implications for international pest risksI selected trade connectivity given the system-scale nature of the talk, but equally it could sit in risk analysis in practice. Happy to be moved around as appropriate.

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(3) Where the (urban) palms are: potential impact of a palm pest on the US mainland

Koch, Frank H.,[1*], Ambrose, Mark J.[2], Cowett, F.D.[3], Burnie, Alan[4], Rysin, Olya[4]

[1]USDA Forest Service, Southern Research Station, Research Triangle Park, NC, USA; [*]presenting author

[2]North Carolina State University, Department of Forestry and Environmental Resources, Research Triangle Park, NC, USA

[3]Cornell University, Horticulture Section, School of Integrative Plant Science, Ithaca, NY, USA

[4]USDA APHIS-PPQ-CPHST-PERAL, Raleigh, NC, USA;

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The recent discovery of the coconut rhinoceros beetle, Oryctes rhinoceros (Linnaeus), in Hawaii has raised concerns about the impact if this or any other alien pest of palms were to be introduced and established in the continental USA. Although a handful of native palm species are found in natural forests, particularly in the southeastern USA, the impact of a palm pest would be felt most acutely in urban areas where non-native palms are frequently planted as street "trees". Unfortunately, urban areas are not inventoried systematically in the USA or elsewhere, leaving large gaps in our understanding of the urban distributions of palms and other plant species that may serve as hosts for emerging pests. In previous work, we used available urban inventory data as the basis for modeling the distributions of three tree genera – ash (F*raxinus* spp.), maple (*Acer* spp.), and oak (*Quercus* spp.) – in all urban and suburban communities of the eastern and central USA. Currently, we are applying concepts from this work to model street palm distributions in communities throughout the continental USA. Preliminary analyses suggest that street palm prevalence is associated with climatic factors that shape the distributions of all plant species, but that the socioeconomic status of communities, their planting histories, and their proximity to the coast also matter. Our ultimate objective is to translate these modeled distributions into an estimate of the economic impact of a large-scale invasion by a palm pest, focusing primarily on communities' costs of mitigating street palm losses.

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(4) Developing a methodology to prioritize EU plant pests based on socio-economic and environmental impacts: the Impact Indicator of Quarantine Pests (IIQP)

Sanchez, Berta[1*], Barreiro-Hurle, Jesus[1], Rodriguez-Cerezo, Emilio[1], Soto-Embodos, Iria[1], Himics, Mihaly[1].

[1]European Commission - Joint Research Centre (JRC), Seville, Spain; [*]presenting author

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The increasing threat of plant pests is a worldwide phenomenon mainly due to the globalization of the plant trade and the effects of climate change. In the last decade, the EU has been confronted with several large scale outbreaks of new plant pests. These pests, of particular importance for the Union territory, deserve better preparedness both at EU and Member State level, with more prevention, detection and control. Resources for pest prevention, detection and control are scarce and have to be allocated. Here, we are developing a methodology to support plant health policy-making based on the soundest scientific evidence for those pests to which resources would be best allocated based on their impact severity. The Impact Indicator of Quarantine Pests (IIQP) is a composite indicator to rank plant pests according to the severity of the economic, social and environmental impact that they can cause in the Union territory. The indicators try to summarize and reflect the recitals and articles of Regulation (EU) 2016/2031. The IIQP should be applied to all quarantine plant pests that can potentially affect EU crop, horticulture and forestry activities. Our results can help to improve plant health preparedness both at EU and Member State level, with more prevention, detection and control.

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(5) A quantitative assessment of the likelihood of Spodoptera frugiperda entering the EU at a sub-national spatial scale, and the effect of mitigation measures

MacLeod, Alan[1*], Day, Roger[2], Early, Regan[3], Gardi, Ciro[4], Hruska, Allan[5], Mosbach-Schulz, Olaf[4], Nagoshi, Rodney[6], van der Werf, Wopke[7]

[1]Defra, York, UK; [*]presenting author

[2]CABI, Nairobi, Kenya

[3]University of Exeter, Penryn, UK

[4]European Food Safety Authority (EFSA), Parma, Italy

[5]UN-FAO, Rome, Italy

[6]USDA, Gainesville, FL, USA

[7] Wageningen University, Plant Sciences, Centre for Crop Systems Analysis, Wageningen, The Netherlands

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Following its introduction and rapid spread in sub-Saharan Africa, the European Commission asked EFSA to conduct a pest risk assessment of Spodoptera frugiperda (Lep: Noctuidae), the fall armyworm, for the territory of the European Union. S. frugiperda is a highly polyphagous pest from the Americas; favoured

hosts are maize, rice and sorghum. It has been intercepted in the EU on a range of fresh produce from the Americas and more recently from Africa. The remit of the risk assessment was limited to the assessment of entry, establishment and risk reduction options. We will present the quantitative assessment of entry into specific EU NUTS 2 regions where climatic factors indicate establishment is likely to be possible. We will also present comparisons of the likelihood of entry via trade pathways with entry via migration of adults on suitable air currents from sub-Saharan Africa. All components of the assessment sit within a recently developed quantitative framework. It is recognised that the pests' rapid spread in Africa could lead to additional pathways originating in northern Africa making entry into the EU even more likely. The effect of risk reduction options on lowering the likelihood of entry via trade will be presented.

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(6) When they've already made up their mind: providing better advice in the real world

Newfield, Melanie J.[1*]

[1]Ministry for Primary Industries, Wellington, New Zealand; [*]presenting author

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Making ad-hoc decisions is a natural human habit, but it is seldom considered a good decision-making process. Nonetheless, it is a common complaint of scientists and advisers that they are advising people who have already made up their minds. Examining the decision-making processes of professionals who are good at rapid decisions has given insight into how to advise decision makers who already have a preferred option. In particular, the Recognition-Primed Decision Making model gives a useful structure for this purpose. This model allows scientists and advisers to better understand exactly what questions need to be answered or hypotheses considered in order to ensure that their advice contributes to good decision-making. Practical examples are presented of the approach based on this model from Plant Biosecurity Risk Assessment at MPI.

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(7) Which risk assessment for decision-makers?

Harman, Helen M.[1*]

[1]Ministry for Primary Industries, Wellington, New Zealand; [*]presenting author

For more information, contact Helen.Harman@mpi.govt.nz

Scientists and advisers can use a range of risk assessment types to inform decision makers who make risk management decisions. Assessments can range along a spectrum from qualitative through semi-quantitative to quantitative. I present here several case studies from the Plants and Pathways Risk Assessment team at the Ministry for Primary Industries, New Zealand, that show a diversity of approaches and highlight the need to be both flexible and adaptive to meet the requirements of risk managers.

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(8) The impact of climate change on the potential geographic distribution and population occurrence of the tomato fruit worm (*Helicoverpa armigera*)

Huang, Yu-Bing[1*], Chiang, Ming-Yaw[1], Ku, Chia-Yin[1]

[1]Division of Applied Zoology, Agriculture Research Institute, Taichung, Taiwan; [*]presenting author

For more information contact ybhuang@tari.gov.tw

Based on the potential geographical distribution of species, ecological niche model assumes that the species can occur in a particular area with appropriate factors including environment, climate, distribution and other biological factors. In this study the geographic distribution on tomato fruit worm in central-southern Taiwan is predicted based on the effect of climatic factors. In order to assess the climate change impact on the distribution of pest or other possible risks for native pest, this research focuses on population growth trends, with the potential geographic distribution and suitable of bioclimatic indices by using CLIMEX. Three objects are described: (1) Comparison of climate change impact on different location. (2) Climate stress effect the geographic distribution of pests. (3) Climatic factor effect on the differences between the weekly growth index and population fluctuation.

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(9) Estimating the pest impact under climate change: Elevated temperature and CO_2 condition reduce performance of *Spodoptera litura* F. due to reducing the nutrition value and secondary compounds on foliage of *Rorippa dubia* Persoon.

Pham Anh, Tuan[1*], Papitchaya, Teawkul[1], Shaw-Yhi, Hwang[1]

[1]Department of Entomology, National Chung Hsing University, Taichung, Taiwan; [*]presenting author

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The increasing of carbon dioxide (CO_2) in atmosphere accompany with temperature are raising concern on environmental issue of global warming. Insect herbivores are expected to suffer direct and indirect effects of climate change through the CO_2 and temperature-induced changes experienced by their host plants. In this study, base on interaction of generalist insect pests (*Spodoptera litura* F.) and wild plant of Rorippa dubia Persoon, I address the question of how elevated CO_2 concentration of 1000 ppm and elevated temperature (29°C) affect on foliage's nutrition (Nitrogen and Carbonhydrate) and allelochemicals (Proteinase inhibitors, Polyphenol oxydase, phenonic content, Glucosinolate), which then possibly affect the performance (relative growth rate) of generalist insect pests (*Spodoptera litura* F). Data revealed the trend of reducing the nutritional quality and defensive compounds that lead to reduce insect performance in context of both intact plants (constitutive resistance) and herbivorous-damaged induced foliage. Output of study emphasize the role of nutritional values, which have been decreased when plant developed under condition of elevated CO_2 and temperature, that consequence reduced the development of herbivorous insect. These finding can support for future prediction of the insect-plant interaction in the context of global warming condition.

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(10) Elevated CO_2 may alter pheromonal communication in *Helicoverpa armigera*

Choi, Kyungsan[1*], Ahn, Seung-Joon[2], Kim, Su Bin[3], Ahn, Jeong Joon[4], Jung, Bong Nam[1], Go, Sang Wook[3], Kim, Dong-Soon[3]

[1]Research Institute of Climate Change and Agriculture (RICCA), National Institute of Horticultural & Herbal Science (NIHHS), RDA, Jeju, Republic of Korea; [*]presenting author

[2]National Institute of Horticultural & Herbal Science (NIHHS), RDA, Wanju, Republic of Korea (current address: Oregon State University, Corvallis, OR, USA)

[3]Jeju National University, Jeju, Republic of Korea

[4]National Institute of Horticultural & Herbal Science (NIHHS), RDA, Wanju, Republic of Korea

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Elevated CO_2 significantly affected behavioral responses of male *Helicoverpa armigera* (Lepidoptera: Noctuidae) in wind tunnel and electroantennogram (EAG) studies. *H. armigera* reared at different CO_2 levels (400, 600, or 1,000 ppm) for three generations were tested. The approach behavior was significantly decreased in normal males reared at high CO_2 level (1,000 ppm). Males with labial palp-removed showed significant reduction in upwind and approach behavior than those of normal males. EAG responses of antenna were not significantly different among CO_2 levels in most sex pheromone doses tested. However, the EAG responses of whole head were significantly lower at 600 and 1,000 ppm of CO_2 than those at 400 ppm of CO_2 at all sex pheromone doses, indicating a CO2 receptor-mediated perception process of sexpheromone. With sequential changes of CO_2 using males reared at normal CO_2, the EAG pattern was largely different between whole head and labial palp-removed head. The relative proportion of the EAG of the whole head compared to that of labial palp-removed head was decreased nonlinearly with increasing CO_2. The lessening effect of EAG may be mediated by CO_2 receptor in labial palp. Consequently, elevated CO_2 negatively affected the pheromone communication system of *H. armigera*. Furthermore, we discussed the increased sex pheromone production in females at elevated CO_2 condition in relation to the adaptive strategy for survival in a changing environment.

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(11) Proportional allocation of inspection resources to heterogeneous strata delivers nominal sensitivity: contradicting an international regulatory standard

Robinson, Andrew[1*], Lane, Steve[1], Cannon, Robert[2], Arthur, Tony[3]

[1]CEBRA, The University of Melbourne, Parkville, Australia; [*]presenting author

[2]Retired, ex-Department of Agriculture and Water Resources, Warrnambool, Australia

[3]Department of Agriculture and Water Resources, Canberra, Australia

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Inspection of consignments of imported goods is commonly undertaken at national borders in order to prevent incursions, study the import system, and deter malefactors. Due to the size of consignments,

inspection of the whole consignment is usually impossible or uneconomic, so inspection of a random sample is used instead. The size of the sample is justified by appeal to International Standards for Phytosanitary Measures No. 31, "Methodologies for Sampling of Consignments", which provides guidance based on choosing a nominal sensitivity (e.g., 0.95) against a specified contamination rate (e.g., 0.5%) using the binomial distribution. For example, a random sample must comprise about 600 units in order to have a 0.95 probability to detect at least one contaminated unit given a 0.5% contamination rate over the whole consignment. However, oftentimes consignments comprise multiple commodities of goods, and can be considered as heterogeneous. ISPM 31 notes that "A lot to be sampled should be a number of units of a single commodity identifiable by its homogeneity [...]" and "Treating multiple commodities as a single lot for convenience may mean that statistical inferences can not be drawn from the results of the sampling." This prescription creates a substantial impost on inspection because it suggests that separate samples of nominal size must be taken from each commodity within each lot (consignment). We prove that if the multiple-commodity consignment is treated as a stratified population and the random sample of units is allocated proportionally to the number of units in each stratum, then the nominal sensitivity at the consignment level is achieved - or bettered. We conclude that the international standard is unnecessarily restrictive, and suggest amendments.

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(12) Optimal surveillance of biological invasions: comparing risk-based and acceptance sampling approaches

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Surveillance of forest pests has been long recognized as a critical component of strategies to cost-effectively control new invasions. We compare a common pest surveillance strategy based on assessing the likelihood of infestation and maximizing the number of detected infested sites with the acceptance sampling approach that minimizes the expected number of undetected infested host plants (trees) in the sites that have been inspected. We further consider the optimal strategy that combines inspections with optional removal of host plants at the surveyed sites to minimize the number of infested trees remaining after treatment within budget constraints. A manager identifies potential survey sites and chooses the proportion of host plants (trees) to remove when infested hosts are found, given the density of hosts, likelihood of infestation, sampling intensity and detection rate. We depict the uncertainty about pest invasion likelihoods with a set of stochastic scenarios and formulate the pest surveillance problem as a scenario-based mixed integer programming model. We further explore the

impact of the uncertainty about the likelihood of infestation and detection probability on the surveillance and host removal strategies. Our problem setting reflects a trade-off faced by decision-makers: whether it is better to allocate resources for inspections or use a portion of funds to remove the infested host at the surveyed sites. We examine the problem using the example of a surveillance program for emerald ash borer (EAB) outbreak in Winnipeg, Manitoba, Canada. Our approach is generalizable and can support delimiting survey and control programs for new pest incursions

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(13) Modelling to predict risks and assess control options for emerging and invasive forest pests

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The European project HOMED (HOlistic Management of Emerging Pests and Diseases) aims to develop scientific knowledge and practical solutions for the management of emerging native and non-native pests and pathogens threatening European forests. HOMED follows a holistic and multi-actor approach. Within HOMED, Wageningen University and INRA will develop generic models for entry, establishment and spread of invasive forest pests and pathogens. These models will feed into a decision support system for end users. Co-creation with end-users is sought to make those models fit for purpose.
Key drivers for continental spread of past invasions in European forests will be identified using meta-analysis. The spread model will predict the rate of spatial range expansion using species traits, and spatially explicit information on climate, host cover and anthropogenic variables. We aim to compare the utility of automatically-fitted species distribution models for mapping the potential range of establishment. A model for spread and control at the scale of an outbreak will be developed to assess the effectiveness of measures (e.g. clearcut-zones). Models will be parameterized and tested on target case studies.

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(14) Spatial dispersion pattern and development of a sequential sampling plan for the Asian citrus psyllid (Hemiptera: Liviidae) in Mexico

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The Asian citrus psyllid (ACP), Diaphorina citri Kuwayama (Hemiptera: Liviidae), is the vector of Candidatus Liberibacter spp., an alphaproteobacterium associated with huanglongbing, the most devastating citrus disease in the world. The pathogen was found in the Mexican citriculture during 2009,

where it has affected to date 15% of the citrus area. In order to know their spatial dispersion pattern, different aggregation indexes were studied (Variance/Mean relationship, Lloyd, Morisita, Iwao's regression, Green, Negative Binomial and Taylor's power law). In addition, to contribute to the vector management in the country, we developed a sequential sampling plan based on the negative binomial. The study variable was the number of ACP adult specimens captured per week in 10,285 yellow sticky traps located in the following citrus orchards: Valencia orange (*Citrus sinensis* (L.) Osbeck), Persian lime (*Citrus latifolia* Tanaka), and Mexican lime (*Citrus aurantifolia* (Christm.) Swingle). The highest average of ACP adults captured week/trap was found in Mexican lime (1.23 insects/trap), followed by Persian lime (0.37 insects/trap), and Valencia orange (0.22 insects/trap). In all cases, variance (s2) was significantly higher than the mean, indicating a better fit to an asymmetric distribution as the negative binomial. All the evaluated indexes indicate that the dispersion pattern of the ACP in Mexico is aggregated. The sequential sampling plan developed is expected to assist the growers in decision-making for ACP chemical control. The spatial dispersion pattern and the sequential sampling plan will help to improve in an efficient and economical way the ACP monitoring and management programs in Mexico.

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(15) The potential global distribution of *Spodoptera frugiperda* sensu lato: sensitivity to climate change and climate variability

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The fall army worm recently invaded Africa, and there is a great deal of concern that it could invade Europe. We developed a CLIMEX model to explore the potential distribution. We draw on a range of tools and data sources to understand the nature of the invasion risks and the relative sensitivity to global climate changes and recent historical climate variability. The CLIMEX results reveal that the invasion risk to Europe is likely to be seasonal, though warmer years could see conditions favouring S. frugiperda s.l. overwintering in the Mediterranean basin. The marginal nature of the climate for persistence and the relative dearth of suitable hosts suggest that the invasion source populations to fuel seasonal reinvasion of northern Europe are likely to remain small. The effects of irrigation are also investigated.

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(16) Mapping the global distribution and potential threatened areas of the papaya mealybug (*Paracoccus marginatus*), using ecological niche models (ENM) and spatial analysis to assist pest risk assessments

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The papaya mealybug (*Paracoccus marginatus*: Pseudococcidae) is a high polyphagous short-tailed mealybug native to Central America, which started to spread to other countries in 1996. This study identifies regions for pest potential establishment based on a spatially-explicit analysis and prediction of the climatic suitability of the papaya mealybug at the global scale using Ecological Niche Models (ENMs). Three ENMs: Maxent, Random Forest, and Support Vector Machines were trained with three different range of species distribution: native, invasive and whole range, three ranges of values for presence-background ratio and three regularization parameters from general to fitted. Models and model parameterization settings were evaluated and selected using the accuracy statistics AUC and sensitivity. The potential distribution was computed for each distribution range, through the ensemble of the mean suitability of best performing models. Areas for potential establishment were calculated using the potential distribution from the native range and the total crop areas of three crops: papaya, cassava, and berries, at the global scale through a spatial overlay. Prediction of the mean suitability using the native range of the species better predicts the range where the species has been reported (invasive range). In general, Maxent and Random Forest with general to intermediate regularization and presence-background ratios close to 1:1 had better performance. Results suggest that several countries in low-developed to developing regions with lower middle to low income, in West and Central Africa, and in Southeast Asia are suitable for pest establishment.

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(17) Why are plant pathogens under-represented in eco-climatic niche modelling?

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Eco-climatic niche models are powerful tools for assessing the potential range of plant pests and diseases, widely applied in comprehensive pest risk assessments globally. We conducted a bibliometric analysis comparing the number of CLIMEX models developed for plant pathogens and plant insect pests. We found that plant pathogens were statistically significantly under-represented, with fungal plant pathogens approximately half as likely as plant pest insects to be the subject of a published niche model.

We explore key factors that may account for this disparity, including inconsistent experimental paradigms and lack of cross-disciplinary (i.e. plant pathology and modelling) expertise

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(18) Warming impact on pest population composition improves biocontrol effectiveness

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Understanding climate warming impact on crop pests facilitates predicting crop dynamics in agricultural systems. However, it remains unclear how warming will affect pest population size and population composition, consequently altering pest colonization in a tri-trophic system (crop-pest-biocontrol agent). To fill the knowledge gap, we studied a crop-pest-biocontrol agent system including soybeans, aphids, and lady beetles, by conducting 1) a laboratory warming experiment to examine warming impact (+2°C or +4°C) on the aphid population size and composition (alate proportion), and 2) a field colonization experiment to examine whether the warming-induced effect on aphids subsequently interacts with biocontrol agents (lady beetles) in affecting aphid colonization. The results showed that warming affected the initial aphid population composition (reduced alate proportion) but not population size; this warming-induced effect strengthened the top-down control by lady beetles and slowing aphid colonization. In other words, biocontrol effectiveness on crop pests (aphids) by biocontrol agents (lady beetles) could improve under 2–4°C warming. Furthermore, aphid colonization was affected by an interaction between the alate proportion and biocontrol agent presence. This study suggests that warming affects pest population composition and likely mediates top-down control on pest colonization by biocontrol agents. This mechanism may be crucial but underappreciated in climate change ecology because population composition (wing form, sex ratio, age/body size structure) shifts in many species under environmental change.

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(19) Impacts of elevated temperature and CO_2 concentration on plant-insect interactions in subtropical regions

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The effects of climate change and extreme weather conditions on plants and animals have been documented extensively. However, the possible effects of these factors on plant-insect interactions in subtropical regions are relatively unexplored. The present study investigated the consequences of elevated CO_2 and temperature on plant–insect interactions in subtropical regions. The experimental conditions were as follows: ambient CO_2, 500 ppm; elevated CO_2, 1000 ppm; ambient temperature,

24/21°C (day/night); and elevated temperature, 29/26°C (day/night). *Brassica oleracea* var. *italica foliar* primary and secondary substances were quantified 6 wk after germination and insect feeding bioassays were subsequently conducted. The results shown that elevated CO_2 has a major influence on the leaf area, biomass, total nitrogen and carbohydrate contents, defensive compounds, and insect consumption rate. Elevated temperature reduced the larval development time and increased the growth rate of *S. litura*. The findings show that the relationship between host plant and *S. litura* are sensitive under rise of CO_2 concentration and temperature condition. Future work is required to elucidate the mechanisms underlying of changes in nutritional quality (bottom-up control) caused by the interactive effects of CO_2 and temperature.

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(20) Effect of sowing dates, climatic variables on major insect pest populations and host plant resistance to pod borer *Helicoverpa armigera* (Hubner) in pigeonpea (*Cajanus cajan* (L.) Millsp.)

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Effect of sowing dates, climatic variables on major insect pests population and host plant resistance studies with special reference to pod borer *Helicoverpa armigera* (Hubner) in pigeonpea (*Cajanus cajan* (L.)) ecosystem was studied at International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) on two cultivars namely, ICPL 87 and ICPL 88039. The insect pest population on two cultivars differed significantly across sowing dates. ICPL 87 was most vulnerable to insect pests as it suffered more damage by the pod borer H. armigera, pod sucking bugs (*Clavigralla tomentosicollis* Stal.) than ICPL 88039. Maximum leaf/pod feeding insect population was recorded on first sowing and then gradually decline for the rest of the plantings. Maximum *H. armigera* egg population exhibited 21.10 on ICPL 87 in first sowing and least 1.23 on ICPL 88039 in sixth sowing. Web forming insect pests *Maruca virata* (3.95) and leaf webber (4.66) was maximum recorded on ICPL 88039 in second and first planting respectively. The leaf feeding beetle was recorded highest 6.29(ICPL 87) in third planting. Amid two cultivars maximum insect-pests population was recorded on ICPL 87 when compared ICPL 88039 except web forming insect *Maruca* and leaf webber due to its indeterminate genotypic character of ICPL 88039. Between two genotypes, the sucking pests more preferred to ICPL 87 when compared ICPL 88039. Maximum jassids was recorded 12.76 and 8.38 (ICPL 87) in fourth sowing and third sowing respectively. It was observed that highest spider population recorded 2.23 (ICPL 88039) in first and second sowing. Lady bird beetle *Coccinella transvasalis* population recorded maximum 8.52 (ICPL 87). The leaf webber (r= 0.449**) and pod bug (r= 0.421**) showed highly significant positive correlation with maximum temperature and H. armigera larvae population exhibited highly significant positive

correlation with minimum temperature (r= 0.491**) and morning relative humidity (r= 0.528**). Solar radiation also exhibited and showed significant positive correlation with leaf webber (r= 533**).

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(21) Effect of changing weather variables on the outbreak of legume diseases

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An abrupt occurrence and distribution of minor diseases in legume crops (chickpea and pigeonpea) are harnessing the area and production in many developing countries. Fluctuation in weather variables (temperature, CO_2 and rainfall patterns) and narrow host range are considered as primary factors for convergence of minor diseases into major. Upsurge and epidemics of these diseases can cause huge losses to these crops. Regular monitoring and surveillance have shown increased incidence (10-80%) of *Phytophthora* blight in *Pigeonpea* and dry root rot (10-50%) in chickpea. Increased mean temperature and flash-rainfall during the early crop growth (50-90 days) stage peak the severity of Phytophthora blight (r^2=0.97). Higher temperature and elevated CO_2 had advanced incubation period of Phytophthora blight under controlled environment. Incremental blight incidence (20%) was recorded under elevated CO_2 (700 ppm) as compared to ambient (380 ppm). The occurrence of dry root rot of chickpea was positively correlated with an increase in temperature and negatively with soil moisture as ≥30°C and 60% soil moisture content rapids-up the dry root rot development in chickpea. Lack of synchrony between diseases and hosts under changed environment variables are making management more challenging and there is a need to use new technologies such as machine learning to map spatial and temporal distribution and realm the climate variables to address the uncertainties of these emerging diseases.

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(22) Population dynamics model to explore waste management areas in Taiwan, using black soldier fly *Hermetia illucens* (Diptera: Stratiomyidae)

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Hermetia illucens is currently one of the most utilized and widely accepted decomposers. *H. illucens* utilization range from biodiesel production to animal feed. Hemolymph of *H. illucens* can also be utilized as a supplement to increase the production of biological control agents such as predatory mites. Among other potential utilizations the obtaining chitin from the extraction of *H. illucens* can increase its utilization, and applied in cosmetics, medicine (artificial skin), and in pharmaceutical preparations

among others. Characterizing the likely population growth and development of *H. illucens* under Taiwan conditions may assist with the mass production and the effectiveness of composting outdoors. A model was created using the DYMEX population modelling software with the support of previously published parameters and with the application of two sex life table derived data from temperature transfers experiments. The model includes, the predicted population behavior of *H. illucens*. Using daily weather datasets from five locations in Taiwan; Zhuzihu, Hualien, Sun Moon Lake, Chiayi, and Hengchun covering the range of conditions that H. illucens could be used as a waste management agent in Taiwan. H. illucens outdoors population was predicted to decline and over-winter during the coolest months but populations during the warmer months will increase. On the other hand if controlled conditions indoors populations can be utilized through all the year. The model predicted biomass production values at each site. The current model can be used as a tool in waste management, larva production and compost production.

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(23) Molecular diversity of rice leaffolder (*Cnaphalocrocis medinalis* Guenée) in Taiwan

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Rice (*Oryza sativa* L.) is one of the most important crops in the world particularly in Asia. However, rice production and quality encounters enormous challenges, such as pests and diseases. The outbreak of rice leaffolder (*Cnaphalocrocis medinalis*) has been recorded as an important pest of rice in Taiwan. There is no C. medinalis biotype have been reported yet. However, understanding the diversity of *C. medinalis* in Taiwan is a very important issue. Thus, we used *C. medinalis* specific sex pheromone trap to collect *C. medinalis* in Taiwan and further used two maternally and bi-parentally inherited markers (mitochondrial AT-rich region and internal transcribed spacer 2) to understand the molecular diversity of *C. medinalis* population in Taiwan. The phylogenetic results showed that there is one population of *C. medinalis* in Taiwan. We further compared DNA sequences of *C. medinalis* in China and Korea. The result indicated that *C. medinalis* among Taiwan, China and Korea were clustered in one major group.

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(24) Invasion dynamics and potential spread of the invasive alien plant species *Flaveria bidentis* (Asteraceae) in China

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Invasive alien plant *Flaveria bidentis* (L.) Kuntze is native to South America. Since it invaded China in 1990s, it has expanded to more than 100 counties (ca. 40,000 km^2) of Northern China. Its rapid spread has caused ecological damage to local agricultural and natural ecosystems. Understanding its historical invasion pattern and potential tendency for further spread is imperative to plan the management of the species. Here, we firstly reconstructed its historical invasion process, then identified its invasion and expansion routes and underlying mechanisms, and finally applied ecological niche modeling (Maxent) to predict potential invasion areas in China on the basis of combination of its native and invasive occurrences as niche comparison in both climatic and geographical space showed its climatic niche might shift when it invaded China. *F. bidentis* has invaded into China with unintentional human activities, and then spread rapidly toward the neighboring of its earliest invaded foci along the roads. Until now, it is still in a stage of rapid expansion. It should continue to spread southwards and westwards from the invaded areas in the future. It is imperative to establish early monitoring at the forefront of expansion and to curb its further spread

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(25) Regulated non-quarantine pests: towards a wider and better application of this international concept in the EPPO region

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Measures against regulated non-quarantine pests (RNQPs) aim to prevent an unacceptable economic impact on the intended use of plants for planting by pests that are already present in the area. Contrary to quarantine pests, the likelihood of introduction of RNQPs is not a relevant criterion because these pests are already present and may be widespread. The term RNQP was introduced in the revised text of the FAO International Plant Protection Convention (IPPC) approved in 1997. To date few countries in the EPPO region have used the RNQP concept explicitly. In December 2016, [European] Union RNQPs have been introduced in EU Regulation 2016/2031 on protective measures against pests of plants, in line with available international Standards. This regulation will be fully applicable in EU member states in December 2019.

EPPO undertook a 2-year project, funded by the European Commission, to develop a methodology to assess suitability for the RNQP status of pests and apply this methodology to pest/host/intended use combinations coming from Council Directive 2000/29/EC and EU Marketing Directives on reproductive material. A methodology allowing a quick risk analysis was developed. This methodology was then applied to approximately 1400 pest/host/intended use combinations within different Sector expert working groups. As an example, when applied to the blackleg disease on seed potatoes, experts recommended the listing of Dickeya and Pectobacterium as RNQPs for the EU. EPPO is now considering how best to extend this recommendation to all of our 52 member countries.

(26) A new EPPO platform for sharing information on planned and completed PRAs

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In 2015, the EPPO Working Party on Phytosanitary Regulations launched a survey to establish the current use of different PRA schemes in the region and the needs of practitioners and risk managers. The intention was to evaluate the capacity for pest risk analysis in the EPPO region and consider priorities for further work by EPPO. One of the conclusions of the survey was that many PRAs are produced at the national level and that sharing them would be useful for EPPO countries. The Working Party agreed that a platform should be developed for sharing national PRAs, including details of PRAs proposed or in preparation. The platform has now been developed and tested and is available to receive and share information. The national contact points entering records may choose for each one whether it is made available only for users in the same Institute, for all registered users in all EPPO countries, or publicly. Files or links can be posted, but it is planned that the documents are archived so they can be retrieved in case the link is broken. The platform is linked to the EPPO database, so basic information on pests is easy to consult.

Abstracts to Posters

(Arranged in alphabetical order by the first author's last name)

The damage fluctuation of strawberry pest in the field

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Tetranychus urticae (Trombidformes: Tetranychoidea) is one of the most important pests of cultivated strawberries (*Fragaria x ananassa* (Rosaceae)) around the world. It causes damage by sucking sap of leaves and affects the yield of strawberry. To understand the pest population trends could improve the efficiency of natural enemy application. The investigation began from November 2016 to April 2017, mainly survey the population fluctuation of *T. urticae*, *Spodoptera litura*, thrips, aphids as well as the disease incidence and the disease severity of grey mold, powdery mildew, and anthracnose. The results showed that the highest occurrence rate of *T. urticae* on Taoyuan No. 1 is 100 % in March 24 and March 30, 2017. The highest number of eggs per leaf is 1047.2 ± 137.2 in March 24, and the highest number of female adults per leaf is 52.4 ± 10.5 in March 16. The other result showed that the highest occurrence rate of T. urticae on Aroma is 28.6 ± 0.1 % in February 17, 2017.The highest number of eggs per leaf is 76.3 ± 81.6 ,and the highest number of female adults per leaf is 2.8 ± 2.9 in December 2, 2016. The disease incidence and severity of grey mold between temperatures is poorly negative correlation but the precipitation is moderately positive correlation. The correlation between fruit anthracnose and temperature is moderately positive.

A plant health risk assessment toolbox "wishlist"

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The Plant Health Risk Assessment community of practice was asked which tools, specifically modelling tools, are lacking that could be developed by the IPRRG. This poster presents a summary of the results. Some of the desired tools pertain specifically to points along the risk assessment pathway, such as entry or impacts, and others on summarising the results of a risk assessment into an overall risk score, or creating summary 'risk maps' based on a variety of spatial data that also indicates uncertainty in a manner that can be appreciated by non-specialists.