Session 3

International Working Group & Country Group Review

47th Meeting of IRAC International, Indianapolis, USA

Thursday - March 29th, 2012

Sucking Pest WG

Jonathan Henen

IRAC Sucking Pest Working Group

IRAC Spring Meeting Report

Indianapolis March 2012

Agenda

- Review of activities in 2011
- A look at the goals for 2011 and what was accomplished
- *Myzus persicae* resistance to neonicotinoids in Southern Europe
- *Myzus persicae* resistance management recommendations
- Asian citrus psyllid poster
- Sucking Pest WG 2012 goals

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Insecticide Resistance Action Committee

SP WG Team Members

Jonathan Henen	Makhteshim Agan	(Chairman)
Ralf Nauen	Bayer Crop Science	
Russell Slater	Syngenta	
Steve Skillman	Syngenta	
Eric Andersen	Cheminova	
Tatjana Sikuljak	BASF	
Matthias Haas	Bayer Crop Science	
Dan Vincent	DuPont	
Luiz Gomez	Dow Agrosciences	
James Thomas	Dow Agrosciences	
Jean-Paul Genay	Nufarm	
Alan Porter	IRAC Coordinator	

SP WG 2011 Activities

Four telephone conference calls:

All dealing with *Myzus persicae* resistance

5/4/2012
13/7/2012
10/11/2012
29/11/2012

Conference calls with Ian Denholm (Rothamsted, UK) covering the analysis work we contracted Rothamsted to carry out with regard to *Myzus persicae* neonicotinoid resistance

Numerous emails with Ian Denholm & team covering the analysis work we contracted Rothamsted to carry out on the *Myzus persicae* neonicotinoid resistance

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SP WG 2011 Activities

Face to face meeting in Barcelona (BCS office) 12 January 2012:

Myzus persicae neonicotinoid resistance

Participants:

- Ian Denholm & his team from Rothamsted
- Pablo Bielza (Univ. Cartagena, Spain)
- Emanulae Mazzoni (Univ. Catolica Piacenza, Italy)
- Carlos Lozano (Servicio Proteccion Vegetales/ Aragon
- Antoni Dolset (Servei Proteccio Vegs/Catalunya)

Phone calls and email exchanges with IRAC Brazil and Alejandro Arevalo (BASF) all dealing with the compilation of the Asian Citrus Psyllid poster

Sucking Pest WG 2011 Goals

1. Follow up on neonicotinoid resistance in Myzus persicae in Southern France, Spain and Italy
   - Monitor resistance
   - Analyze findings
   - Compile recommendations

Done

2. Compile Asian Citrus Psyllid poster
   - Relevant to Brazil & USA

1st draft ready

3. Compile Brown Plant Hopper poster
   - Relevant to S. E.Asia

No progress

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2010 began with M. persicae as our main focus, but 2011 can really be dubbed as "Year of the Myzus"

- **The green peach aphid *Myzus persicae* dominated the Sucking Pest WG's 2010 agenda**

  ***Myzus persicae* resistance to neonicotinoids**

  - In past very few cases of neonicotinoid resistance since chemistry introduced in 1991
  - All cases so far identified based on metabolic resistance (whiteflies, plant hoppers, potato beetles)
  - Until 2009 no major cases of resistance in aphids was identified
  - Small shifts reported in populations collected from peach or tobacco
  - Since 2003 there have increased reports of reduced performance of neonicotinoids in French peach crops with one population positively identified in 2009 with high levels of resistance
  - Resistance mechanism is both metabolic (over expression of CYP6CY3 monoxygenase gene) & target site (nicotinic acetylcholine receptor mutation).
  - Confirmed by Rothamstead Research , Syngenta & BCS

Key Activities in 2011

• ***Similarly to 2010, t*he green peach aphid *Myzus persicae* dominated the Sucking Pest WG's agenda**

Rothamstead Research (Ian Denholm) conducted the following work as contracted by IRAC SP WG:

• Profiling of known resistance mutations in European populations of Myzus persicae using molecular tools
• They ran a study with Myzus field samples collected by IRAC member companies and sent to Rothamstead
• The samples were characterised by molecular tools for NNI-resistance mutation, MACE, kdr, super-kdr & Esterase
• Initial results were presented to the SP WG via Email and followed up with a conference call
• Main results were presented at the face to face meeting in Barcelona

Sucking Pest WG Activity: Meeting with Spanish & Italian Representatives (Barcelona)

Participants:

- Martin Williamson, Chris Bass & Ian Denholm (Rothamsted , UK)
- Pablo Bielza (Univ. Cartagena, Spain); Emanulae Mazzoni (Univ. Catolica Piacenza, Italy)
- Carlos Lozano (Servicio Proteccion Vegetales/ Aragon
- Antoni Dolset (Servei Proteccio Vegs/Catalunya)
- IRAC Sucking Pest Working Group members:
  - Ralf Nauen & Matthias Haas (BCS), Russell Slater & Stephen Skillman (Syngenta), Andreas Huber (DuPont), Jonathan Henen (MAI)
- Hosted by Josep Izquierdo (IRAC Spain, BCS)

Location & date: BCS Offices - Barcelona, 6.1.2012

Sucking Pest WG Activity: Meeting with French Authorities

Participants:

- Mr Bertrand Bourguin – Expert National “Arboriculture Fruitière”
- Stephen Skillman, Syngenta CP AG (IRAC Sucking Pest Working Group)
- Gerald Huart, Makhteshim AGAN (IRAC, Pollen Beetle Working Group)

Location & date: Ministry of Agriculture, DRAAF de Midi-Pyrenees, Toulouse, 21.2.2012

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Meeting Outcomes

Action	Whom	When
Disucss strategy with Fruit Specialists and provide feedback to IRAC SPWG (Steve Skillman)	B. Bourguin	4th week Feb
Modify the IRAC statement accordingly to reflect the French position, circulate to SPWG for approval	Russell/Steve	1st week March
Schedule an IRAC SPWG telecon for early March to discuss the French response and agree the IRAC statement	Jonathan	ASAP for 1st or 2nd week March
Get IRAC Central Committee approval for the statement	Jonathan	2nd week March
Distribute the statement to authorities in France, Spain and Italy and also to IRAC member countries for final review and agreement by end of 3rd week March	SPWG	End 2nd week March
Issue IRAC statement	Alan Porter	End 3rd week March
Prepare statement for BSV (Bulletin Santé Vegetal – ZOOM-Arbo) to diffuse recommendation to Technical Services in the Midi-Pyrenees Region	B. Bourguin	3rd week March latest
Start work on “Note Nationale” from the ministry to be issued latest December 2012	B. Bourguin with CtiFL and INRA	May-November 2012

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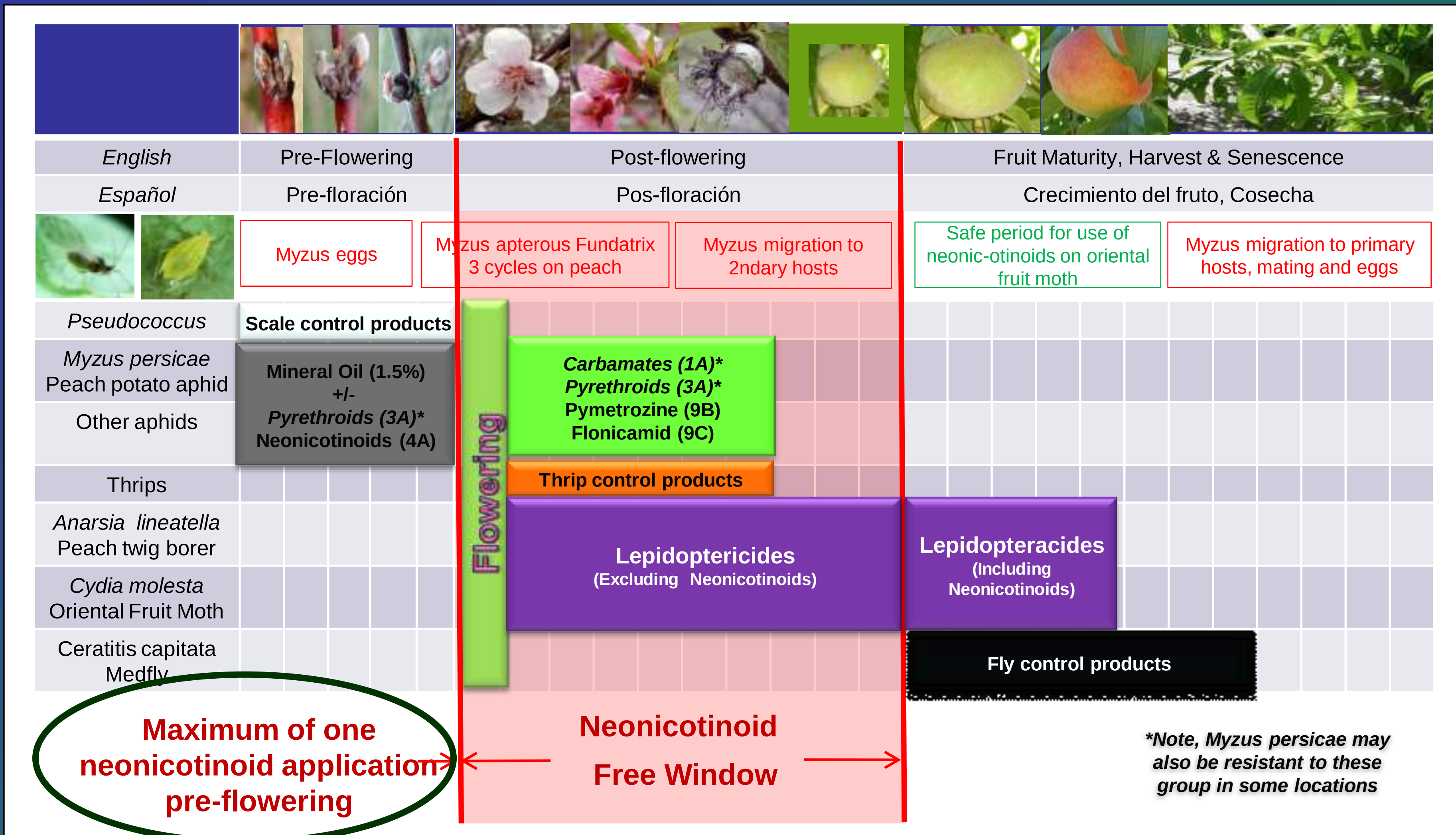
IRAC management recommendations for neonicotinoid-resistant *Myzus persicae*: E.g.: Peaches, Nectarines in Spain



IRAC

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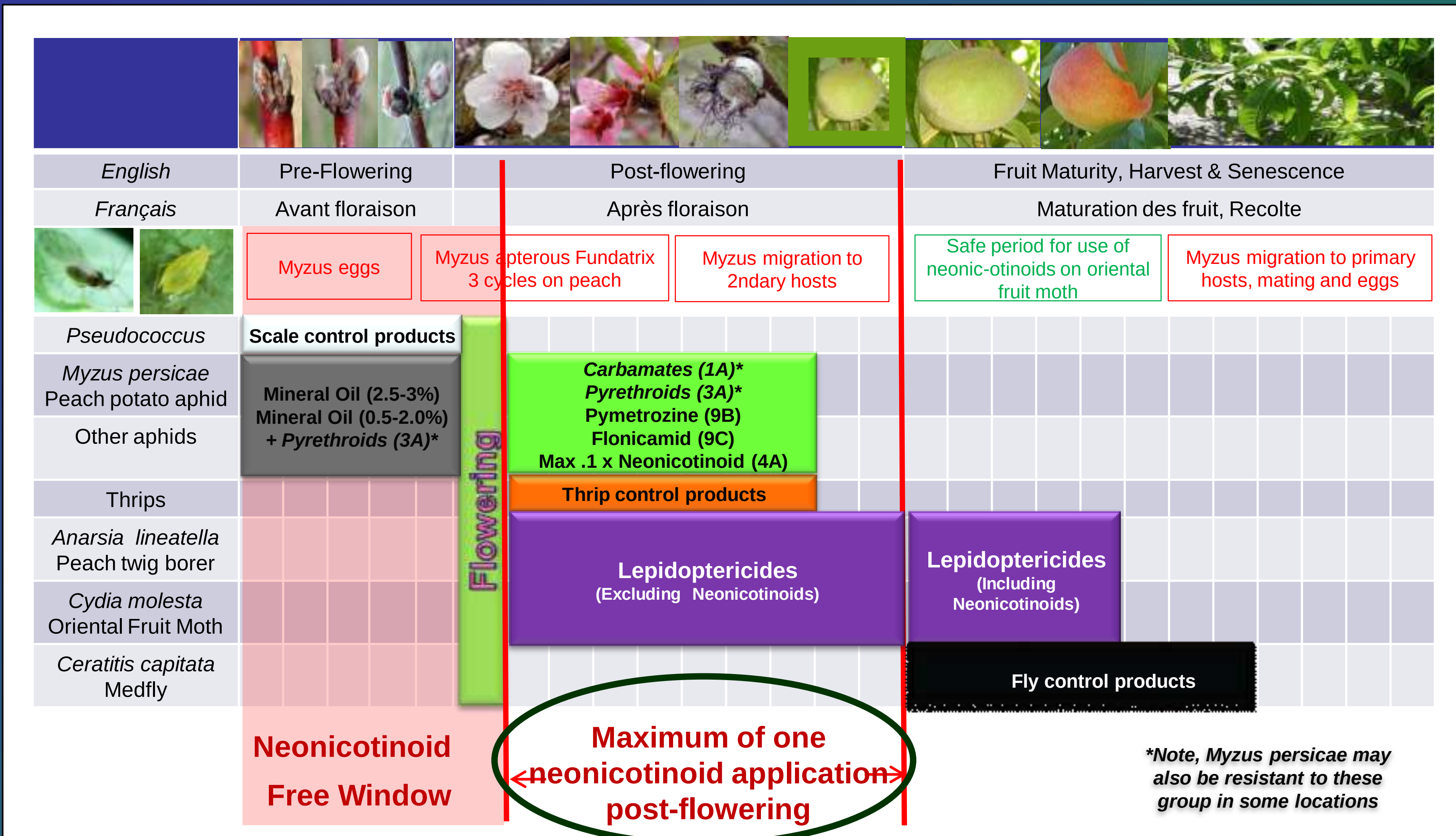
IRAC management recommendations for Neonicotinoid-resistant *Myzus persicae*: E.g.: Peaches, Nectarines in FRANCE



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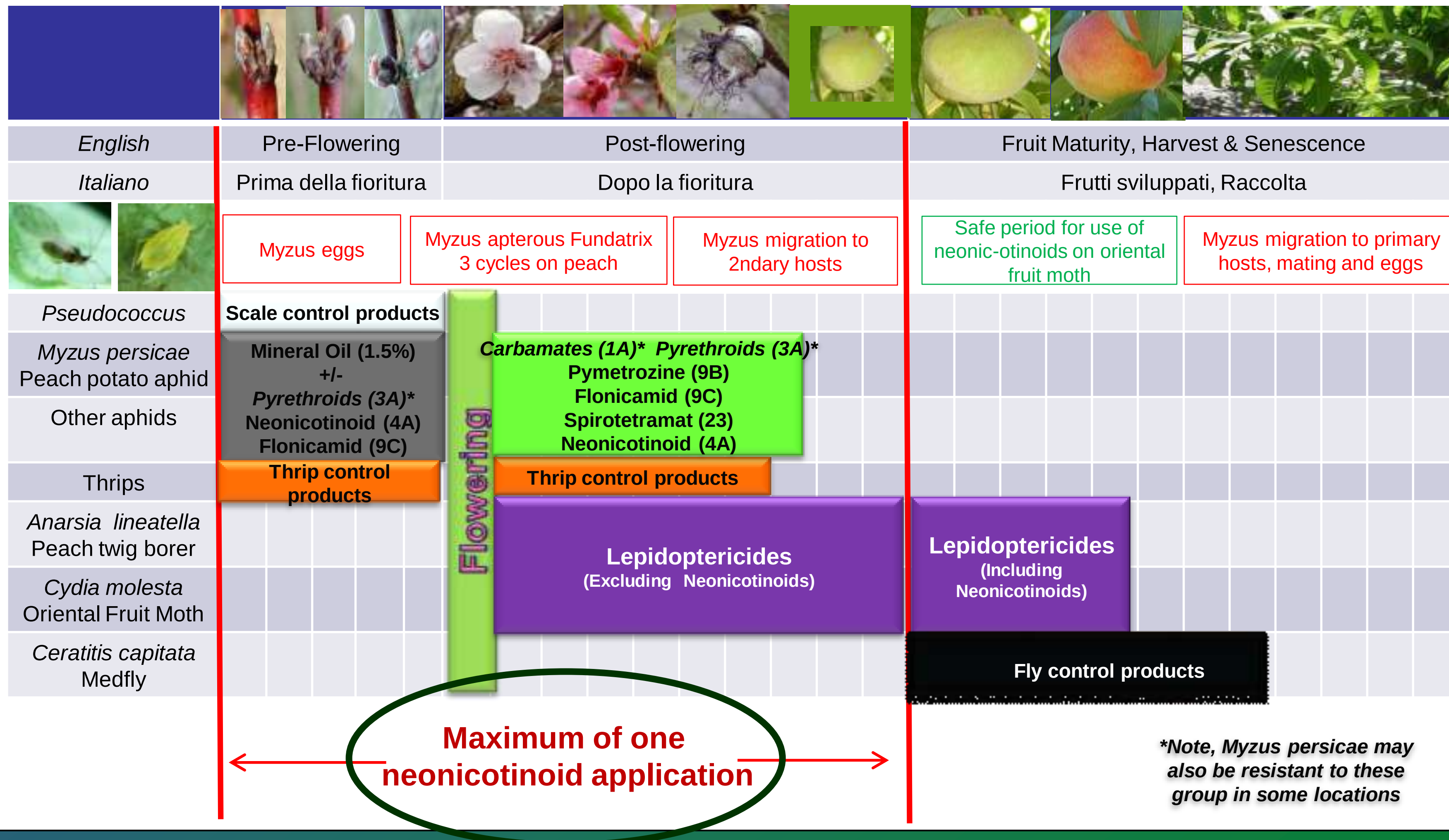
IRAC management recommendations for Neonicotinoid-resistant *Myzus persicae*: E.g.: Peaches, Nectarines in ITALY



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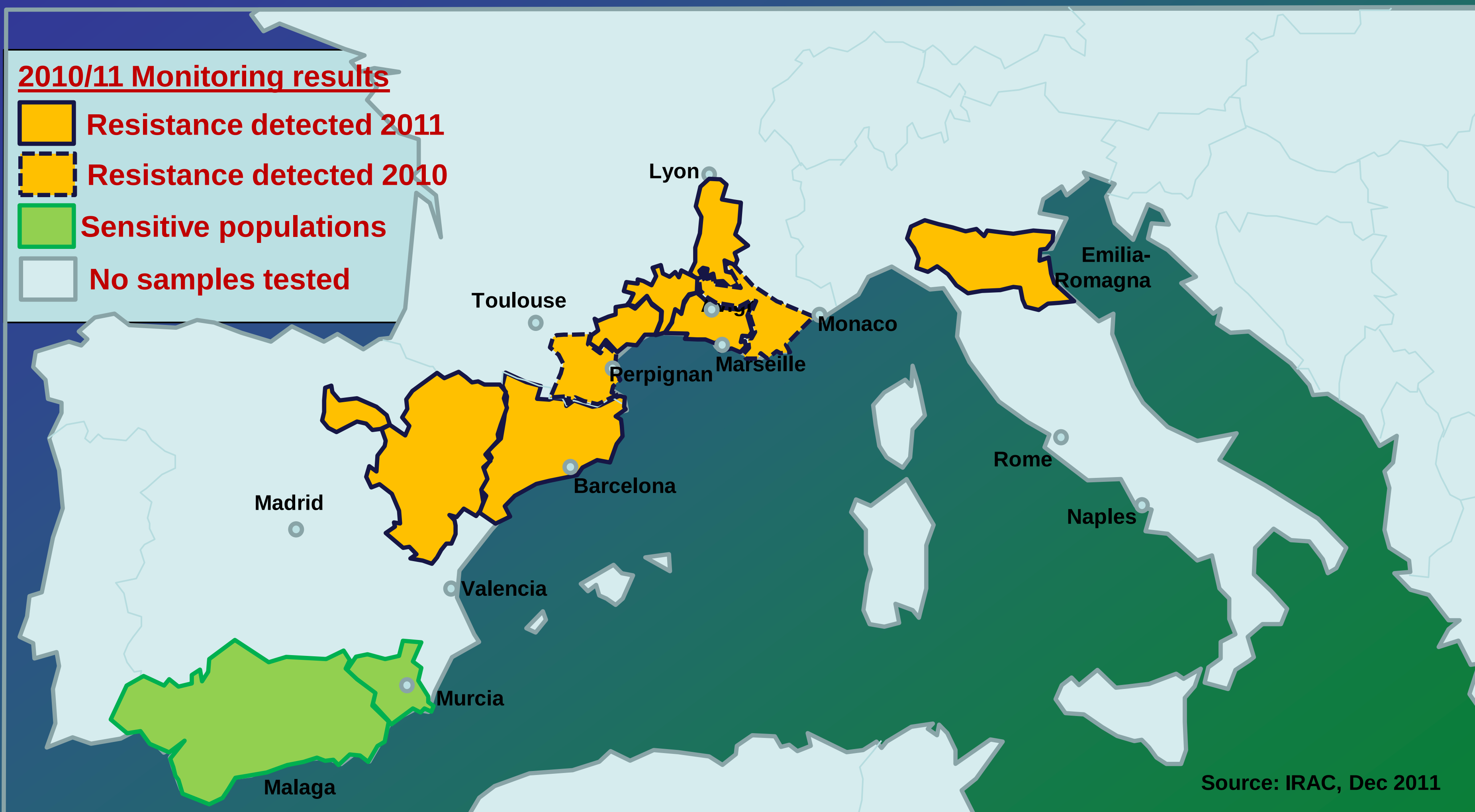
2010/11 Monitoring results of the spread of neonicotinoid resistance Myzus persicae



Lessons to be learnt

- Do not assume that the relevant authorities in different countries will see eye to eye on resistance issues – this means that recommendations end up becoming country specific rather than regional

- Allow for more time for meetings with authorities and required follow up

- If possible initiate the process much earlier – late autumn or early winter to allow for enough time for related activities to be carried out and for follow up with authorities

- Are we interested in carrying out further work and analysis of the aphid sampled for other types of resistance?

Global Poster Launch

- 1st Global sneak review of the initial draft of the Asian Citrus Psyllid Poster
- Thanks to Hector Alejandro Arevalo, Senior Research Scientist BASF
- Also to Tatjana who recruited Alejandro for the job
- Current status:
    - Poster has been sent to Pedro Yamamoto and Celso Omoto in Brazil for their input as for now it has a US bias

The Asian citrus psyllid, *Diaphorina citri*: Resistance management the base for a successful IPM program

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Introduction and Biology

The Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama (Fig. 1a.), is the insect vector associated with the bacteria *Candidatus* Liberobacter asiaticus and *C. L.* americanus. These bacteria are suspected to be the causal agents of Huanglongbing (HLB) in Asia, and America. Infected citrus trees start showing symptoms such a fruit drop and mottled leaves anywhere from 5 months up to 3 years after inoculation. During these initial asymptomatic period of time, the plants can also be source of inoculum, hence the need to manage the vector even if the trees are not showing symptoms (Fig. 2b.). Once the trees are infected, the production will decline rapidly rendering the infected trees unproductive in a few years, if left unmanaged.

Fig. 1: (a.) Adult of *D. citri* feeding on a young orange leave. (b.) HLB infected trees: asymptomatic (left) and symptomatic (right). Notice fruits on the ground, leaf coloration, and dieback more prominent on the symptomatic plant

Eggs are laid on the inner-side of unfolding leaves which protects the eggs and the young nymphs from proper insecticide contact. There are 5 nymphal stages requiring 15 to 47 days after ovipostion to become adults depending on environmental conditions. Nymphs acquire the bacteria and the adults are in charge of vectoring it to uninfected plants and re-inoculated plants that are already infected. Adults are more often the targets for insecticide applications, since they vector the bacteria and the nymphs are protected from contact insecticides by the developing leaves.

Resistance to Insecticides

Various levels of insecticide susceptibility have been reported in Florida, USA (Table 1). Although, the values are not very high in comparison to the resistant values of other pest, it is concerning that the efficacy of some of the most used insecticides is already declining after 5 years of *D. citri* management in the USA. For this reason we encourage growers to practice a Integrated pest management aprach of this pest, with emphasis in sustainability, and rotation of MoA.

Table 1: Highest RR_{50} values observed on various wild population of *D. citri* in Florida in 2010. (Tiwari et al. 2011)

	imidacloprid	chlorpyrifos	thiamethoxam	malathion	carbaryl	spinetoram
RR_{50} adults	35X	18X	15X	5X	3X	2X
RR_{50} nymphs	4X	3X	No tested	No tested	3X	6X

Susceptibility Test Method 002

This management plan has been created based on several recommendations by Universities and Institutions working with Citrus psyllid in Brazil and the US. There are several MoA available to be sprayed in each one of the annual phenological stages of the plant. It is very important to rotate these MoA to reduce the potential for resistance. Rotating types of application for the same a.i is not beneficial for resistance management. An application by drench should not be follower by a foliar application of the same MoA, this will encourage resistance in the wild populations.

Sampling methods ad the establishment of local thresholds are recommended to reduce the amount of calendar sprays. Management of adults during the Pre-bloom-dormant season is key to maintain los populations the rest of the cycle.

Management Plan cont.

Table 2: Management plant and opportunities for MoA rotation used for *D. citri* control.

	Pre-bloom Dormant	Bloom	Harvest	Growing
Sampling	X	X	X	X
Spray strategy	• Cooperative area-wide applications	• No applications of a.i. toxic to bees • Augmentation of natural enemies	• Avoid orange blocks with workers present	• Apply according to sampling and local thresholds • Augmentation of natural enemies
Type of a.i	• Broad spectrum		• a.i. with short PHI	• Reduced risk a.i
IRAC MoA				
1B	X			
3	X		X	
4			X	X
5				X
15			X	X
18				X
23				X
Min. Oil	X	X	X	X

Relevant Literature

Arevalo. H.A., A.B. Fraulo, G. Snyder, and P. A. Stansly. 2011. Citrus Greening Bibliographical Database. University of Florida. http://swfrec.ifas.ufl.edu/entomology/extension/hlb/

IRAC. 2009. IRAC Susceptibility Test Methods Series, Method 002. Psylla spp. Version 3. http://www.irac-online.org/wp-content/uploads/2009/09/Method_002_v3_june09.pdf

Rogers, M.E., P.A. Stansly, L.L. Stelinski. 2012. 2012 Florida Citrus Pest Management Guide: Asian Citrus Psyllid and Citrus Leaf Miner. IFAS – University of Florida. ENY-734. http://edis.ifas.ufl.edu/in686

Tiwari, S., R.S. Mann, M.E. Rogers, L.L. Stelinski. 2011. Insecticide Resistance in Field Populations of Asian Citrus Psillid in Florida. Pest Management Science 67: 1258-1268

Initial Text (1)

The Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama (Fig. 1a.), is the insect vector associated with the bacteria *Candidatus Liberobacter asiaticus* and C. L. americanus. These bacteria are suspected to be the causal agents of Huanglongbing (HLB) in Asia, and America. Infected citrus trees start showing symptoms such as fruit drop and mottled leaves anywhere from 5 months up to 3 years after inoculation. During this initial asymptomatic period of time, the plants can also be source of inoculum, hence the need to manage the vector even if the trees are not showing symptoms (Fig. 2b.). Once the trees are infected, production will decline rapidly rendering the infected trees unproductive within a few years, if left unmanaged.

Eggs are laid on the inner-side of curled/folded leaves which protects the eggs and the young nymphs from proper insecticide contact. There are 5 nymphal stages requiring 15 to 47 days after oviposition to develop into adults depending on the environmental conditions. Nymphs acquire the bacteria and the adults are responsible for vectoring it to uninfected plants and for re-inoculation of plants that are already infected. Adults are the mainthe targets of the insecticide applications, since they are the vectors of the bacteria while the nymphs are protected from contact insecticides by the developing leaves.

Initial Text (2)

Various levels of insecticide susceptibility have been reported in Florida, USA (Table 1). Although, the values are not very high in comparison to the resistant values of other pests, it is concerning that the efficacy of some of the most commonly used insecticides is already declining after only 5 years of *D. citri* management in the USA. For this reason we encourage growers to practice an Integrated Pest Management approach to this pest, with the emphasis on sustainability and rotation of Modes of Action.

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Initial Text (3)

	Pre-bloom Dormant	Bloom	Harvest	Growing
Sampling	X	X	X	X
Spray strategy	• Cooperative area-wide applications	• No applications of a.i. toxic to bees • Augmentation of natural enemies	• Avoid orange blocks with workers present	• Apply according to sampling and local thresholds • Augmentation of natural enemies
Type of a.i	• Broad spectrum		• a.i. with short PHI	• Reduced risk a.i
IRAC Moa				
1B	X			
3	X		X	
4			X	X
5				X
15			X	X
18				X
23				X
NR. Oil	X	X	X	X

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2012 Goals

1. Disseminate IRAC recommendations to all relevant authorities & continue monitoring of neonicotinoid resistance in Myzus persicae in Southern France, Spain & Italy
    - First get Executive approval of recommendations
    - Distribute IRAC recommendations in relevant countries
    - Continue aphid sampling and resistance monitoring (Would require budgeting & executive approval)
    - Conduct continual analysis of findings
    - Compile new recommendations if required

2. Finish Asian Citrus Psyllid poster
    - Relevant to both Brazil & the USA

3. Compile Brown Plant Hopper poster
    - Relevant to S. E. Asia

4. Define new sucking pest resistance issues requiring IRAC intervention

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Thanks

- Rothamsted UK: Martin Williamson, Chris Bass & Ian Denholm
- Pablo Bielza (Univ. Politec. Cartagena), Emanuele Mazzoni (Universita Catolica Piacenza, Italy)
- Spanish Authorities: Carlos Lozano Servicio Protección Vegetales/Aragon, Antoni Dolset Servei Protecció Vegs/Catalunya
- Barcelona Meeting participants: Josep Izquierdo (IRAC Spain, Bayer), Andreas Huber (Dupont), Ralf Nauen & Matthias Haas, (Bayer), Russell Slater & Stephen Skillman (Syngenta), Jonathan Henen (MAI)
- Special Thanks to BayerCropScience Spain and to Josep Izquierdo for hosting the meeting in the Barcelona BCS premises
- French Meeting participants: Stephen Skillman (Syngenta) & Gerald Huart (MAI)