Use of IPM in horticultural crops – challenges and opportunities

Rosemary Collier
BCPC Pests and Beneficials Annual Review
26 January 2017
establishing a framework for Community action to achieve the sustainable use of pesticides

Member States should promote low pesticide-input pest management, in particular, ‘Integrated Pest Management’ and establish the necessary conditions and measures for its implementation.
Horticultural crops

- Essential for our health and well-being!
- Small physical footprint
- Significant economic value
- Extremely diverse – species and growing systems
- Quality is paramount
Diversity of species!
Do annual field crops provide the ‘ultimate challenge’?

- Protected
- Semi-protected
- Annual field
- Perennial

Diversity of cropping systems

Environmental control

Permanence
Quality is paramount

- Quality determines marketable yield

- Uniformity is very important – size/shape, appearance and maturity date

- Contaminants are unacceptable – even if they are beneficial insects!

- Marketed part of plant can sometimes be protected without direct application of pesticides
Pesticides

- Armoury restricted – particularly when considered by crop
- Small market - so limited commercial incentive to develop new products
- SOLAs & EAMUs have saved the day...
- SCEPTRE and now SCEPTRE+
Insecticides

- Were OPs, carbamates, pyrethroids......

- Now pyrethroids, neonicotinoids, diamides, spinosyns, tetronic and tetramic acid derivatives, oxadiazines, benzoylureas, pyridine azomethine derivatives, flonicamid, sulfoximines...

- But we need to look after our molecules – we may not get many more!
Insecticide resistance has implications for horticulture

<table>
<thead>
<tr>
<th>Species</th>
<th>1A Carbamates</th>
<th>1B Organophosphates</th>
<th>2A/3B OCs</th>
<th>3A Pyrethroid</th>
<th>4A Neonicotinoids</th>
<th>15 Bzoylureas (IGRs)</th>
<th>21A METI</th>
<th>28 Diamides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aphis gossypii</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aphis nasturtii</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bemisia tabaci</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macrosiphum euphorbiæ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Myzus persicae</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasonovia ribisignri</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phorodon humuli</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psylla pyricola</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trialeurodes vaporiorum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aleyrodes proletella</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adoxophyes orana</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plutella xylostella</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuta absoluta</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delia antiqua</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delia radicum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delia platura</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uromyza huidobrensis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phoridae</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psila rosae</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drosophila suzukii</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scaptomyza flavia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sciaridae</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meligethes (aeneus)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frankliniella occidentalis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thrips tabaci</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acarus siro</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panonychus ulmi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tetramyces urticae</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: IRAG
All outdoor vegetables - areas treated with different insecticides – aphicides in green, pyrethroid insecticides in black and other caterpillar control in purple

Pesticide Usage Survey Report 257 - Outdoor Vegetable Crops United Kingdom 2013
Cultural control
Physical methods
Chemical techniques
Host plant resistance
Pest biology
Behavioural methods
Biological control
Genetic techniques
Regulatory controls
Timing

IPM tools!
## Cultural control

- Rotation
- Spatial separation
- Managing alternative hosts
- Crop hygiene
- Cover crops
- Increased diversity – spatially and temporally

- Value underrated?
- Specialisation can limit scope to implement
Biocontrol – tomato production

- Protected
- High value
- System developed to accommodate pollinators and avoid insecticide resistance

Inundative/inoculative biocontrol

- Well-developed system – need to adapt when new problem arrives e.g. *Tuta absoluta*

Transferable to open fields?
Inundative/inoculative biological control

<table>
<thead>
<tr>
<th></th>
<th>GLASSHOUSE</th>
<th>OPEN FIELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Released predators</td>
<td>Captive</td>
<td>Free</td>
</tr>
<tr>
<td>Boundary effects</td>
<td>Bounce back</td>
<td>None</td>
</tr>
<tr>
<td>Hungry predators</td>
<td>Search better</td>
<td>Leave faster</td>
</tr>
<tr>
<td>Environment</td>
<td>Controllable</td>
<td>Highly variable</td>
</tr>
<tr>
<td>Alternative food</td>
<td>None</td>
<td>Many sources</td>
</tr>
</tbody>
</table>

Similarities between systems = NONE!!
Conservation biocontrol - orchards

- Predatory mites that are resistant to insecticides
- Earwigs
Conservation biocontrol with sweet alyssum

Syrphid numbers in water traps
Warwick Crop Centre UK

Transferable to other climates?
Physical control

- Impact on other pests – flea beetles?
- Impact on pathogens – mildew?
- Other changes in management?
Host plant resistance

- Some good examples – but few in number (small market?)

- Relatively long timescale

- Need to protect the mechanism – *Nasonovia* resistance lasted 10 years!

- Relatively little effort is being made to breed for pest resistance?

- Little funding available for phenotyping considerable amount of genetic variation available in gene banks and other collections of plant genetic diversity
Behavioural methods
Decision support

▶ Monitoring
  – Traps
  – Other approaches
  – Crop

▶ Forecasting

▶ Role of networks?
Thresholds!

- Do they have a role in horticulture?
- Growers risk-averse due to high quality requirements
- Varieties and growing systems very diverse
Mobility of pests?

© Pkuczynski

© CC-by

© Scott Bauer

6 million ha

430,000 ha
And where is the selection pressure applied?

![Pyrethroid use graph]

Pyrethroids - vegetables/salads
Pyrethroids - oil seed rape
Pyrethroids - potato
Pest management at a landscape scale?

- Which crops and wild hosts are reservoirs for pests and diseases?

- Green bridges?

- Functional biodiversity is not easy to implement and manage
  - efficacy is not proven and not predictable.
  - needs to be coordinated at a landscape scale.
How well are we doing?

- Great progress in protected crops - outdoor crops further behind

- Ehler (2006) talked about integrated *pesticide* management (the other IPM) - the *discriminate* use of pesticides...

- Suggested that although laudable, this perpetuates a ‘quick-fix mentality’ that targets symptoms and fails to address the root causes of pest problems
Achieving IPM?

- Have we sufficient effective tools to achieve the levels of pest control we need? If not, how do we acquire them?

- Whole crop IPM?

- Are there ‘big’ wins in simply improving use of appropriate control measure at appropriate time in appropriate place – and at a landscape scale?

- How do we encourage uptake and optimal use of IPM tools? E.g. AMBER project!

- What is the role of the state versus industry?

- Collaboration is likely to be key when resources are limited! Importance of Europe?
Thank you to

> Organisers of this meeting

> Agriculture and Horticulture Development Board

> G’s

> Innovate UK

> My colleagues at the University of Warwick

> Colleagues on EIP Focus Group – ‘IPM for Brassica’