Things to Think About When Designing Pollen and Nectar Residue Studies

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Ornamental Horticulture Pollinator Workshop

Gradient of Neonicotinoid Residues in Plant Matrices

Most relevant for dietary bee risk assessment

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Plant Selection

- Commercially available
- Flowers produce both nectar and pollen and at sufficient quantities that can be collected (preferably by hand)
- Bee attractive
- Receive insecticide applications
- Examples:

Cotoneaster

Crabapple

Sweet Autumn Clematis

Pollen and Nectar Collection Techniques Using Bees

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Pollen and Nectar Collection by Hand

- Outdoor plants
  - Collect flowers from plants early in the morning and bring back to lab or field station
    - Nectar robbed by bees
    - Nectar flow dries up in afternoon
- Greenhouse plants
  - Timing might not be as critical but morning might be best (nectar)
- “Typically” try to collect nectar first and then let flowers dry to collect pollen
  - Some flowers are unique so need to be able to adapt

Pollen Collection Techniques By Hand

Pollen is a challenging matrix to analyze!

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Nectar Collection Techniques By Hand

Measure sugar content with refractometer

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Sample Quantities of Various Matrices

Matrix	Quantity of Sample
Nectar	100 µl
Pollen	100 mg
Flowers	100 g
Leaves	100 g

Factors Affecting Residues in Nectar and Pollen

- Timing of application
  - Foliar – closer to bloom typically results in higher residues
  - Soil – closer to bloom doesn't always result in higher residues
  - Uptake and decline (see next slide)
- Water
  - Foliar – rainfall can wash off some residues
  - Soil – some water needed to get AI into the plants via the roots but high rainfall/over watering could move AI out of the root zone
- Soil type
  - Foliar – not much influence
  - Soil – coarse soils can lead to higher uptake but susceptible to leaching; fine soils or soils with high organic matter can retain AI
- Plant variety
  - Foliar – not much influence
  - Soil – different varieties can take up and metabolize AI differently

Uptake and Decline of Systemic Pesticides

- Not well understood for all compounds especially in potted plants
- Timing of applications could result in peak concentrations prior to bloom, during bloom or post-bloom
  - Timing of peak concentrations in the plant should coincide with pest pressure however if at time of bloom this could be problematic
- Questions to be answered
  - Can timing of applications be adjusted to control pests yet minimize residues in nectar and pollen?
  - Are there “BMPs” to help reduce residues in nectar and pollen?
    - e.g. Flushing potted plants with water prior to bloom?
  - How long does the AI stay in the root zone after planting and is there potential for residues to be present in nectar and pollen at second bloom?

Replication and Controls

- Three replicate plots/greenhouses
- Triplicate samples from plots
- Collecting pollen and nectar from plants with extended flowering times or multiple flowering events should be considered
  - Early-, mid-, late-bloom; first bloom, second bloom, etc.
- Controls
  - Verify baseline levels of pesticides in sample matrices
  - Can be used to collect material from various matrices for analytical method development

Data Reporting

- Distribution of residue concentrations is important
  - Centile values
  - Median values might be more appropriate than means
  - Box and whiskers plots

- Include values < LOQ

- Putting data into the context of risk

Summary

- For pollinators – focus should be on residues in nectar and pollen
  - Choose your plants wisely!
- Techniques have been established for collecting nectar and pollen in various crops – don’t reinvent the wheel
- Pollen and nectar residue studies can be labor intensive – many hands make for easier work but need to manage the help accordingly
- Research should focus on current pesticide use practices and if residues in nectar and pollen have the potential to pose risk to pollinators other lines of evidence need to be considered along with potential mitigation options