Biological Control of Spotted Wing Drosophila

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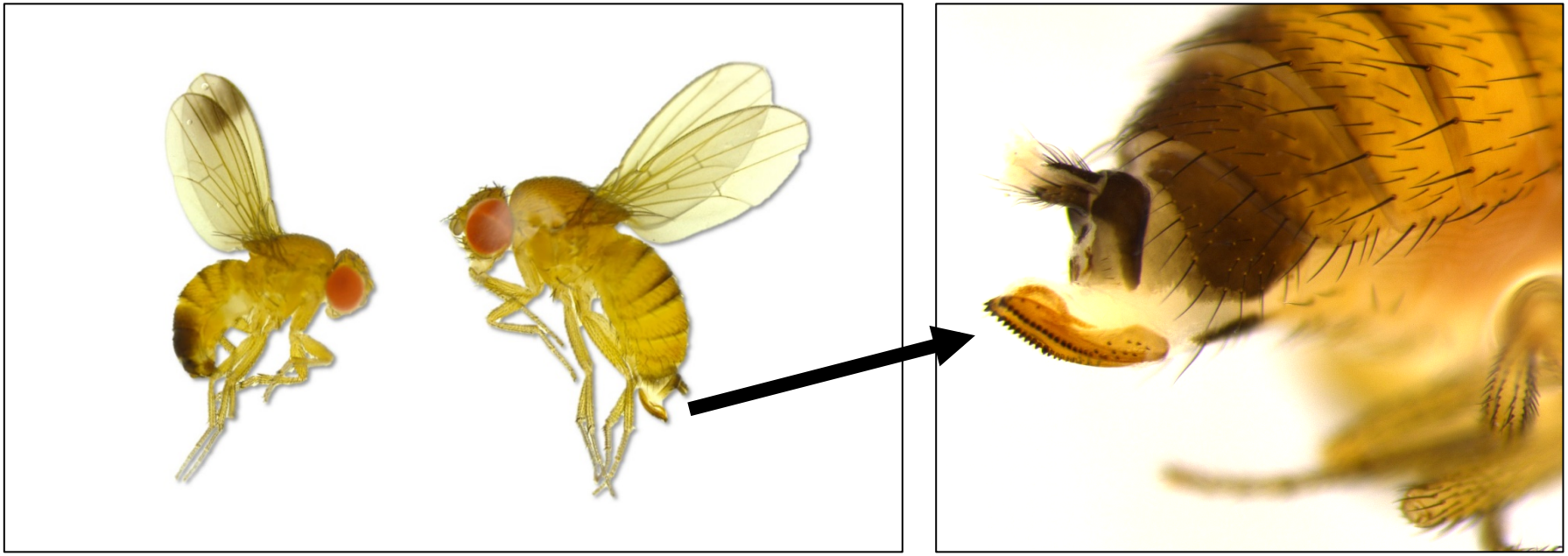
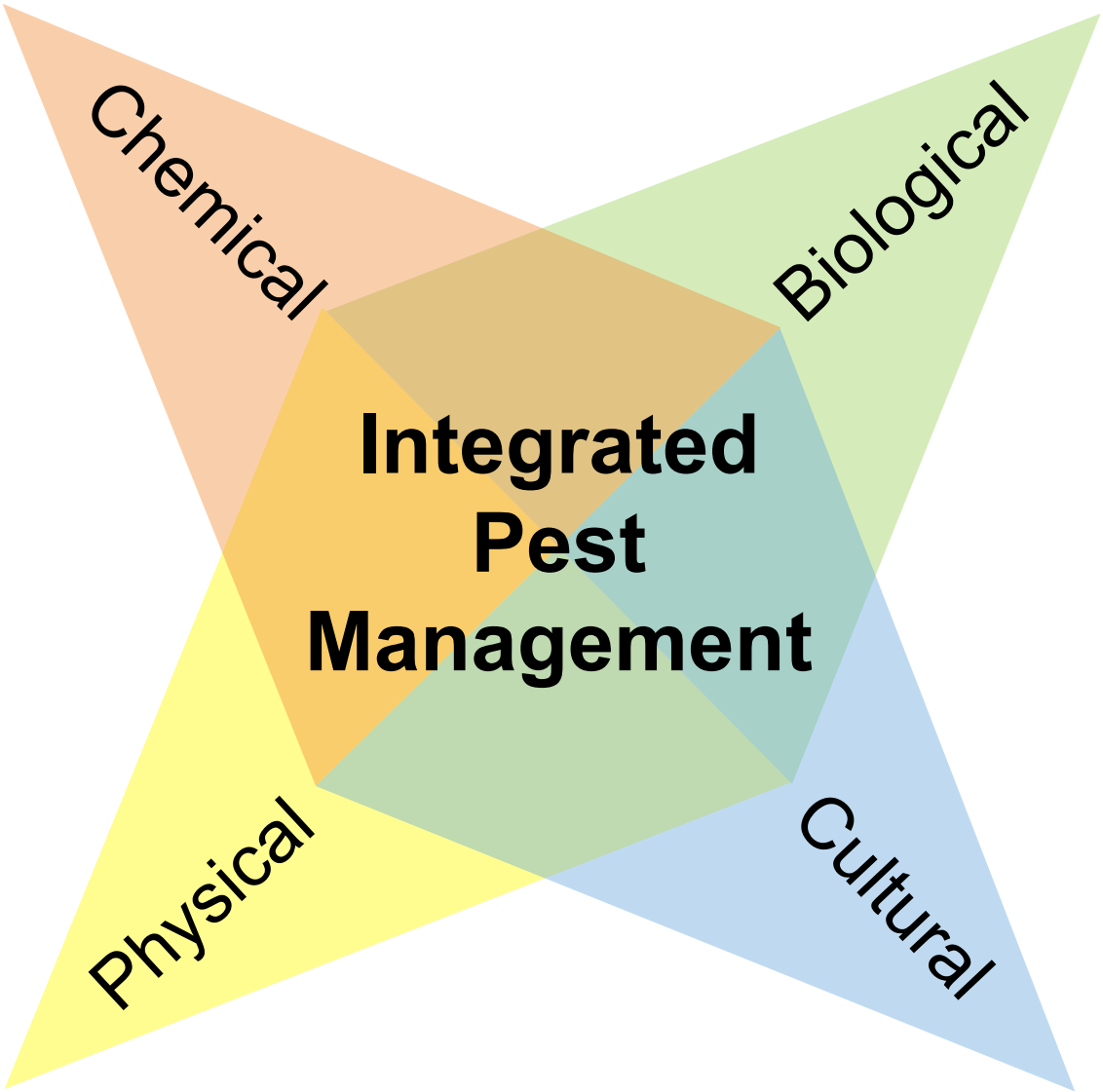
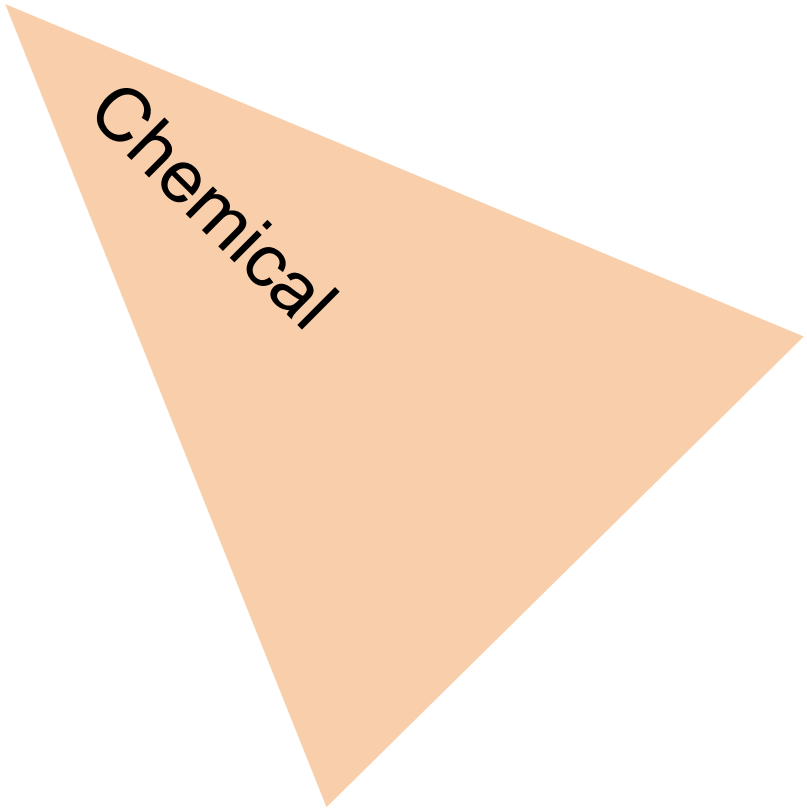
Spotted Wing Drosophila



Integrated Pest Management



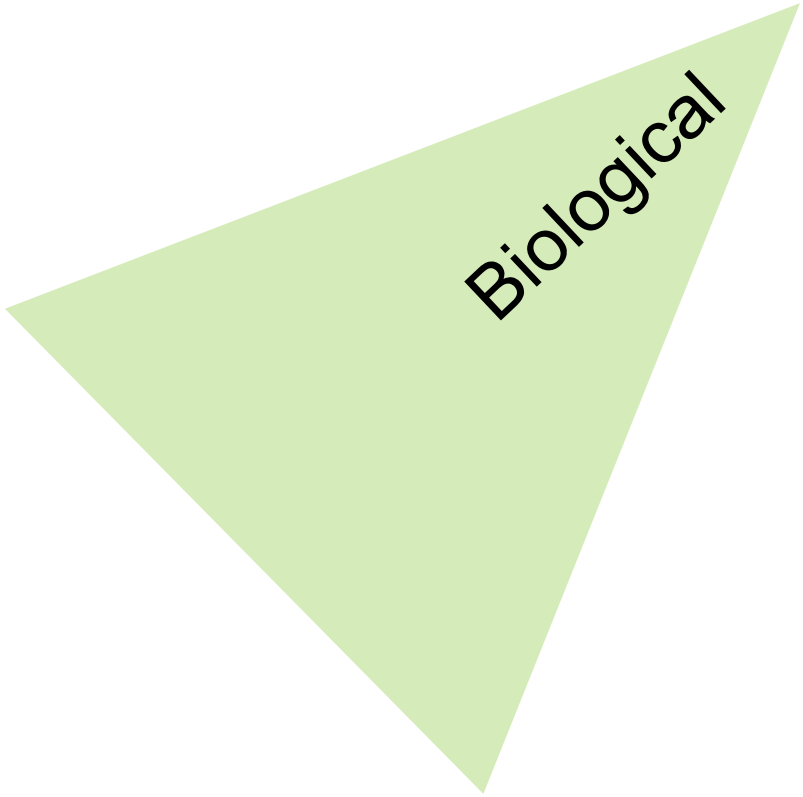
Chemical management



Cost
Sprayer fatigue
Rain wash-off
Limited organic options
Resistance management
Maximum residue limits
Secondary pests
Sustainability

Biological management

Long-term control
No additional costs to grower
Sustainable



What will make an effective biological control?

Host specific

Highly active (predation, egg-laying)

Can be mass-produced

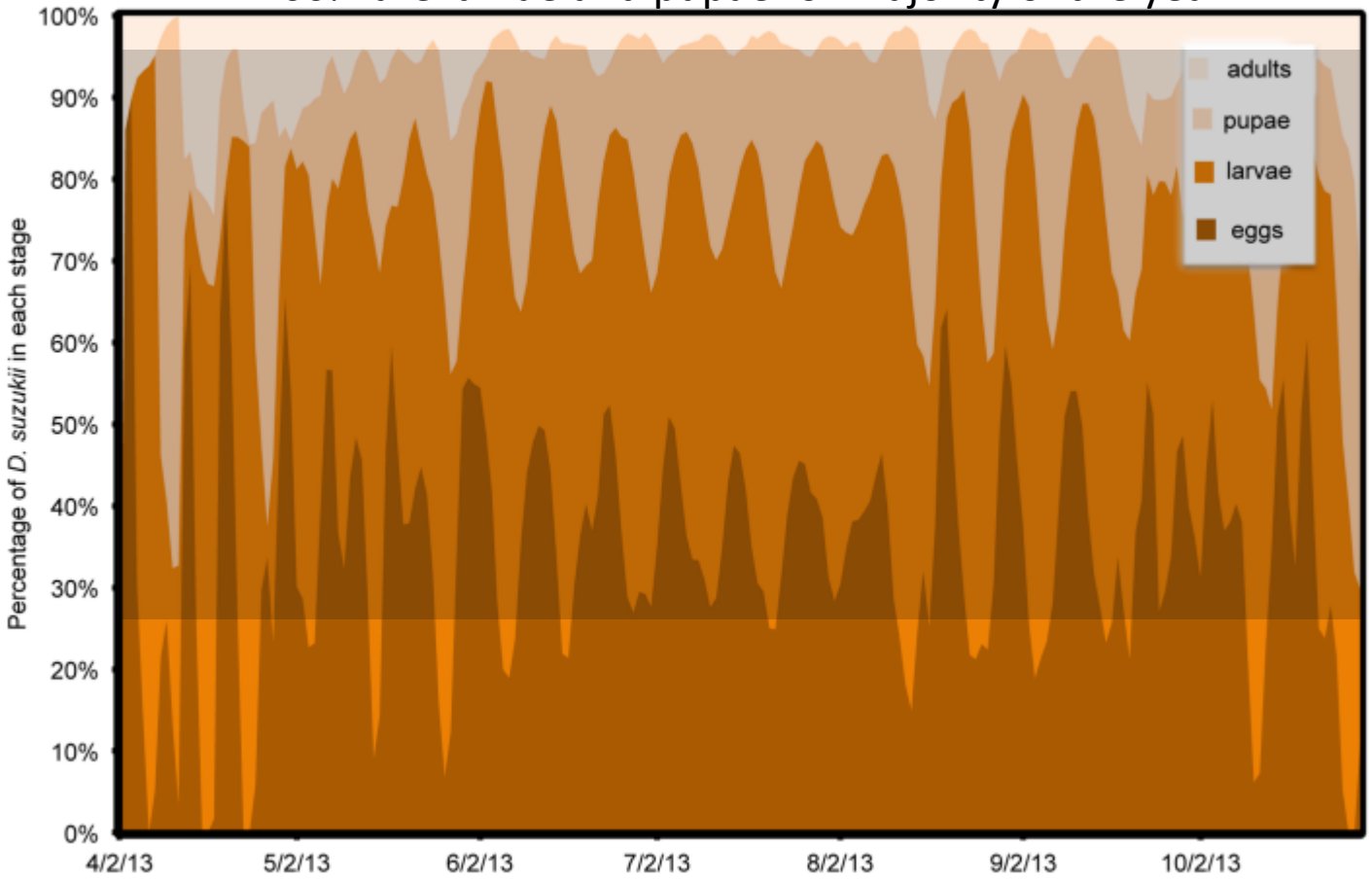
Can withstand range of temperatures

Will establish in environment

Targets the juvenile stages

Target the juvenile stages of SWD

>60% are larvae and pupae for majority of the year



Wiman et al. 2014

Outline

What natural enemies attack SWD in the U.S. and Europe?

Are they enough to control SWD?

What natural enemies exist in the native regions of SWD?

When/how will those be released to control SWD?

Lab evaluation of commercially available biocontrols

Nematodes

- *Steinernema carpocapsae* ✗
- *Steinernema feltiae* ✗
- *Heterohabditis bacteriophora* ✗

Fungal Pathogens

- *Beauveria bassiana* ✗
- *Metarhizium anisopliae* ✓
- *Paecilomyces fumosoroseus* ✗
- *Lecanicillium muscarium* ✗

Predators

- *Orius laevigatus* ✓
- *Labidura riparia* ✗

Woltz et al. 2014

Lab evaluation of commercially available biocontrols

Fungal Pathogens

Metarhizium anisopliae ✓

Up to 61% mortality with direct spray

Death takes up to 13 days

Does not affect number of eggs laid

No residual activity

Woltz et al. 2014

Lab evaluation of commercially available biocontrols

Predators

Orius laevigatus ✓

50% reduction in larvae in small dishes

12% reduction in lab cages

No significant reduction in field conditions

Woltz et al. 2014

Predators of SWD larvae in the field

In strawberries, larvae increased by 19-34% with predator exclusion

In blueberries, larvae increased by 28-49% with predator exclusion

Ants

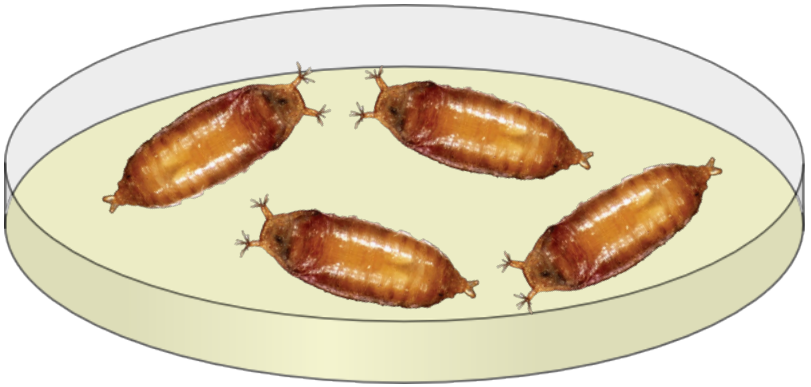
Spiders

Rove Beetles

Woltz et al., unpublished

Predators of SWD pupae in the field

61-91% reduction in pupae when predators allowed access



Ants and spiders were very common

Ants dig up buried pupae and carry them away

Also found harvestmen, centipedes, and earwings

Woltz et al., unpublished

Survey of native parasitoids

Surveys conducted in Europe, California, Oregon, and Michigan

Fruit collections

Sentinel traps

Low parasitism rates found

Pteromalidae
Pachycrepoideus vindemiae

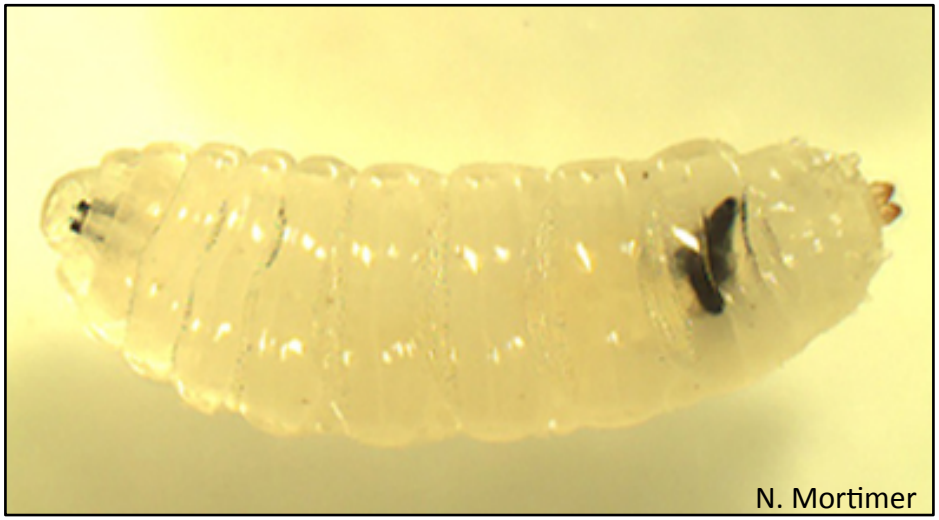
Diapriidae
Trichopria drosophilae

Pupal Parasitoids

Figitidae
Leptopilina heterotoma
Leptopilina boulardi
Ganaspis sp.

Larval Parasitoids

Encapsulation



Native Michigan parasitoids

Parasitoid ID by Kim Hoelmer, USDA-ARS:

Pachycrepoideus vindemiae

Unknown *Asobara spp.*

No figitids (larval parasitoids)

Native European parasitoids

Leptopilina boulardi

Leptopilina heterotoma

Trichopria drosophilae

Asobara tabida

Pachycrepoideus vindemiae

Chabert et al. 2012
Rossi Stacconi et al. 2015

Native European parasitoids – commercially available in 2017

M. Podymniak

Bioplanet

Current natural enemies not providing stable or significant control

Fungal pathogens and nematodes not successful

Predators in field surveys decreased SWD larvae and pupae

Low parasitism rates and encapsulation of parasitoids

Classical biological control

To introduce a new organism to the U.S., it must:

- Have high target control

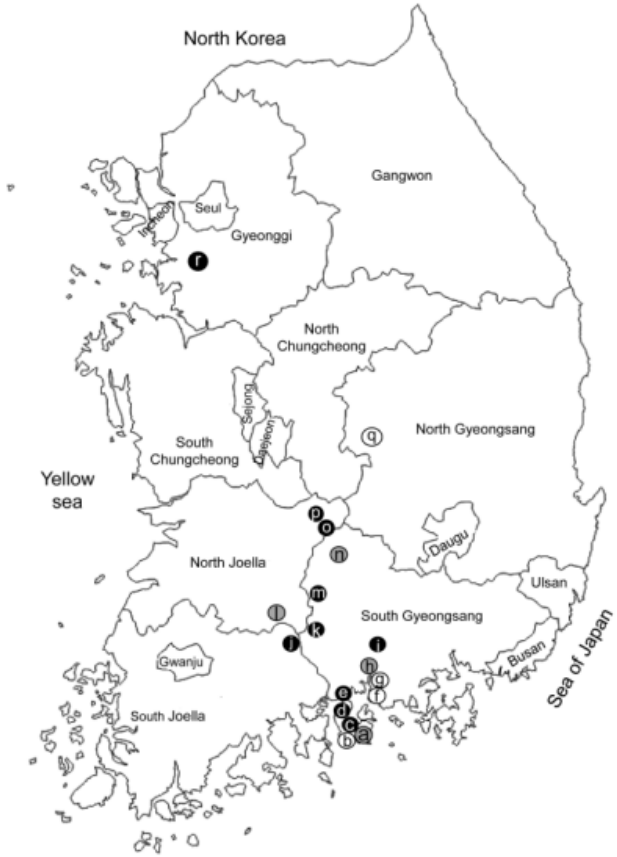
- Low chance of attacking non-targets

- No chance of attacking economically important, endangered, or otherwise valued species

Exploration for SWD parasitoids in Asia

Led by Kent Daane

2013, 2014, 2016 in South Korea and China



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Exploration for SWD parasitoids in Asia

South Korea, June 2016	China, July 2016
11,575 SWD pupae collected	11,683 SWD pupae collected
149 figitids	929 figitids
22 braconids	22 braconids
3 diapriids	3 diapriids
~6% parasitism	up to 75% parasitism

Five common SWD parasitoids found

Trichopria drosophilae

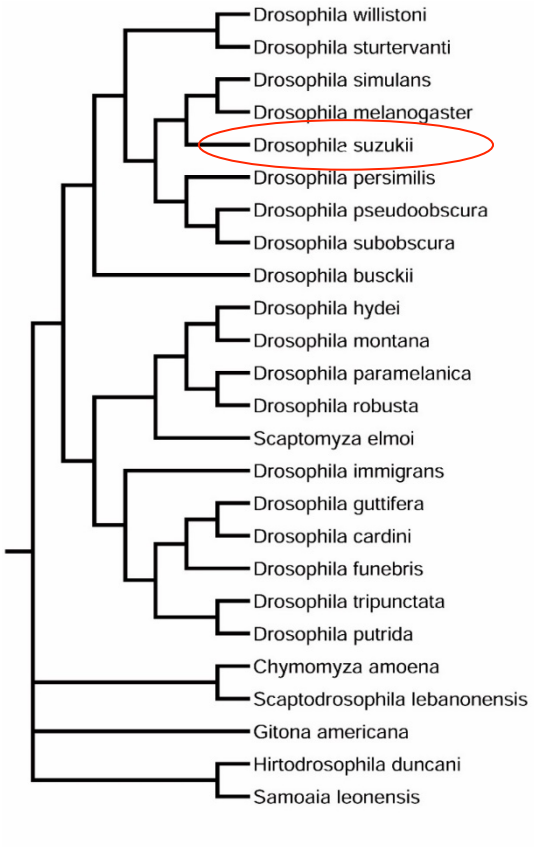
Pachycrepoideus vindemiae

Asobara japonica

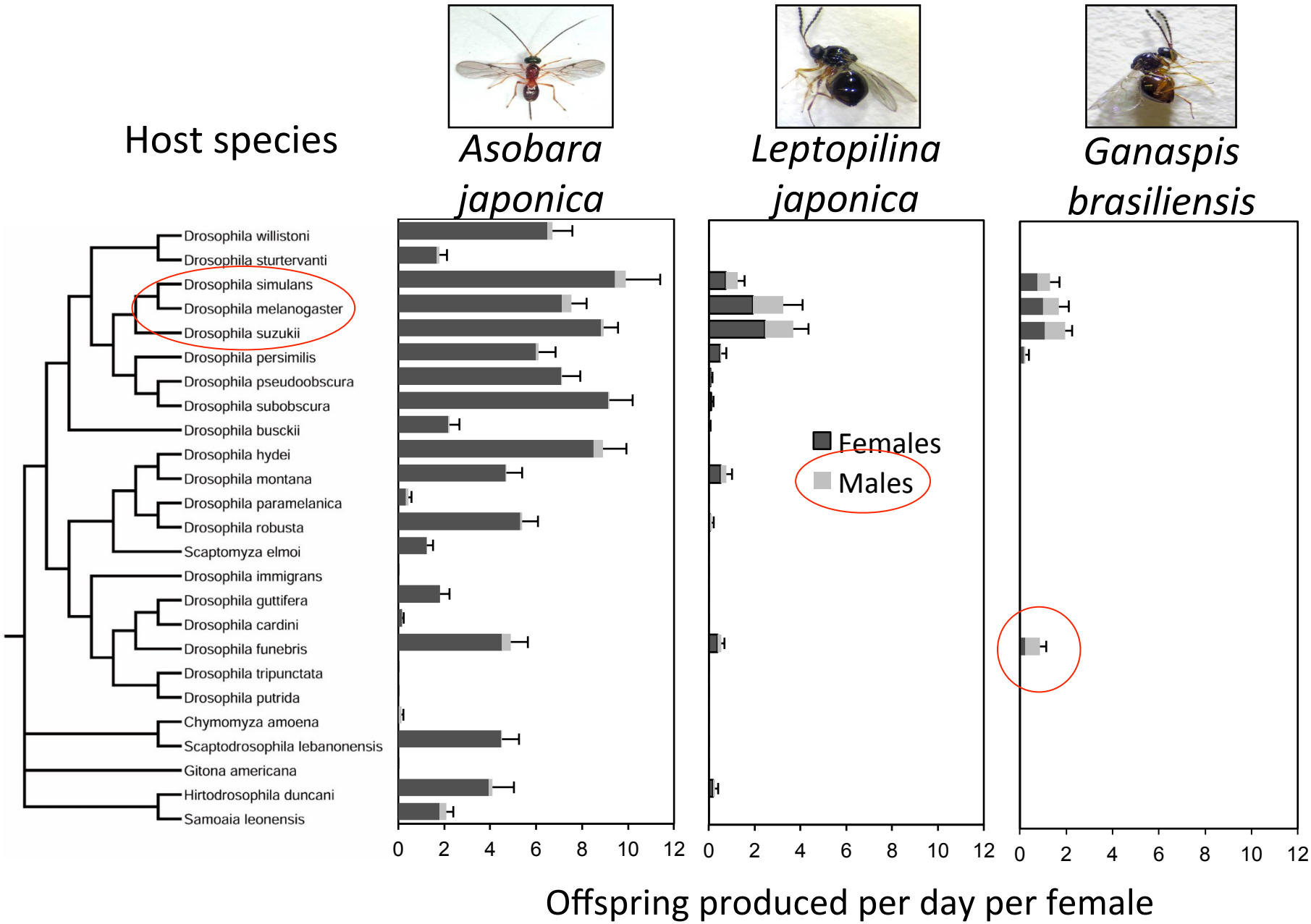
Leptopilina japonica

Ganaspis brasiliensis

Host species



Daane et al., unpublished



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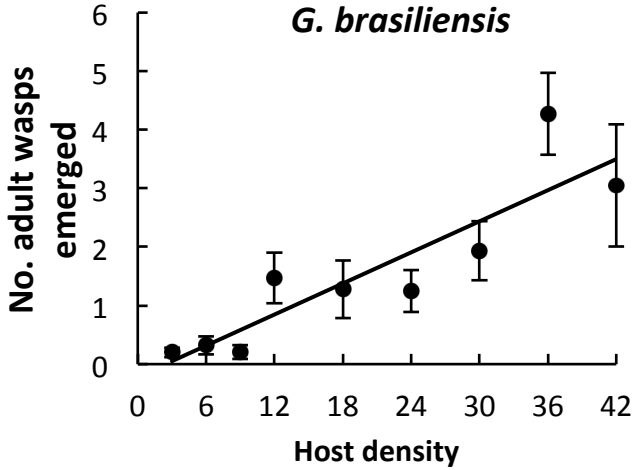
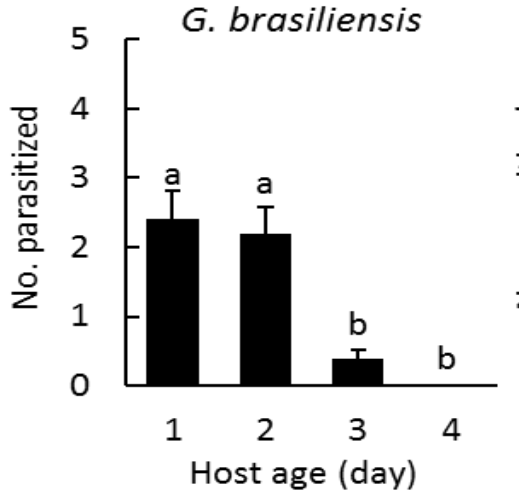
Daane et al., unpublished

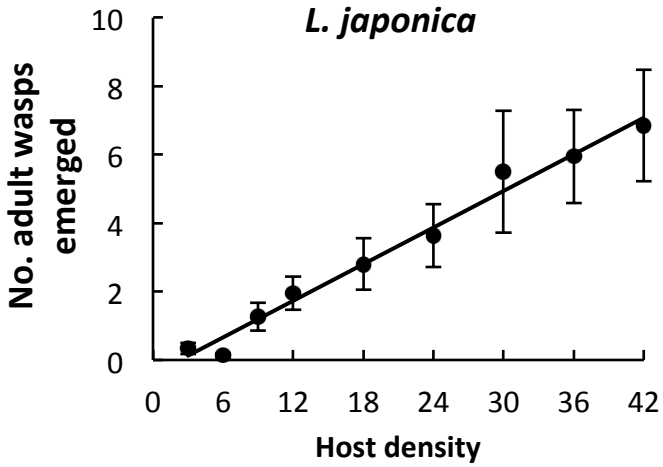
Who should be released?

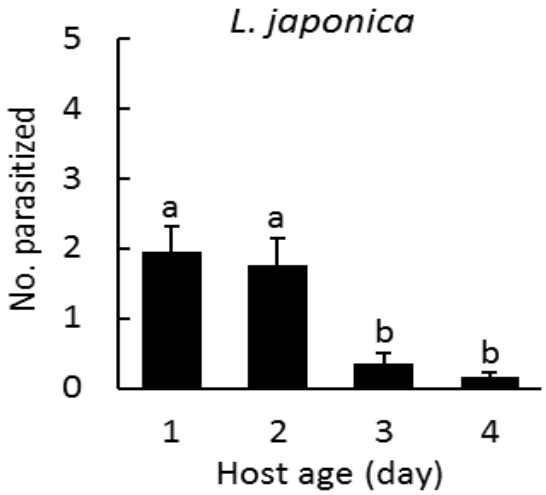
Ganaspis brasiliensis





Leptopilina japonica





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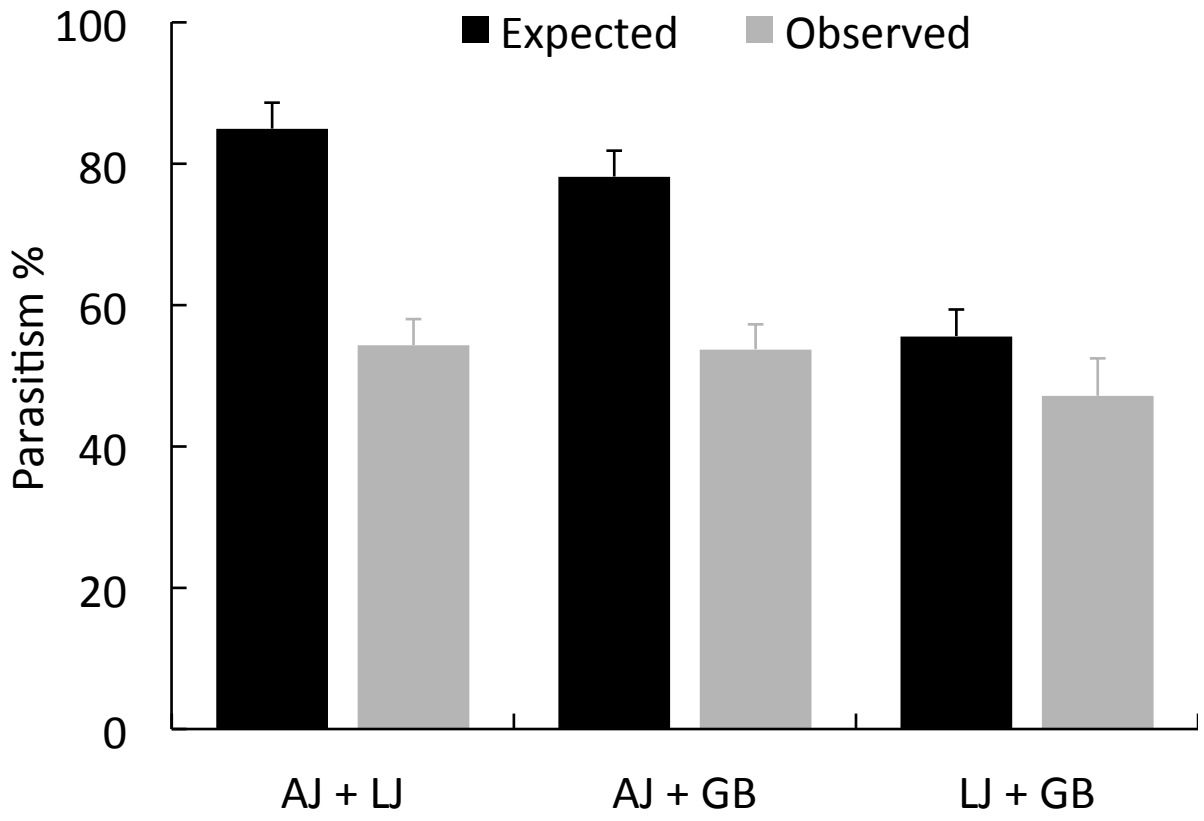
Daane et al., unpublished

Both species are synergistic



Ganaspis brasiliensis

Leptopilina japonica

Daane et al., unpublished

Will they be effective biological controls?

Host specific ✓

Highly active (predation, egg-laying) ✓

Can be mass-produced ✓

Can withstand range of temperatures N/A

Will establish in environment N/A

Targets the juvenile stages ✓

When will they be released?

USDA APHIS permit request submitted Nov 2016 to release *Ganaspis brasiliensis* and *Leptopilina japonica* from UCB Quarantine

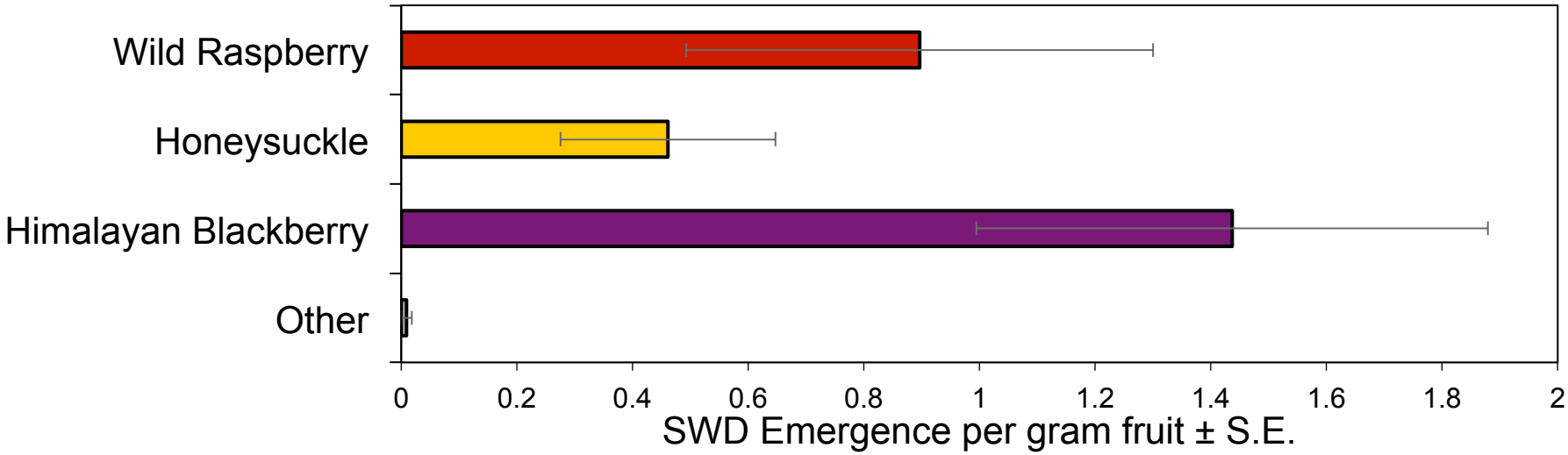
Expecting results by end of 2017 for release in 2018

How will they be released?

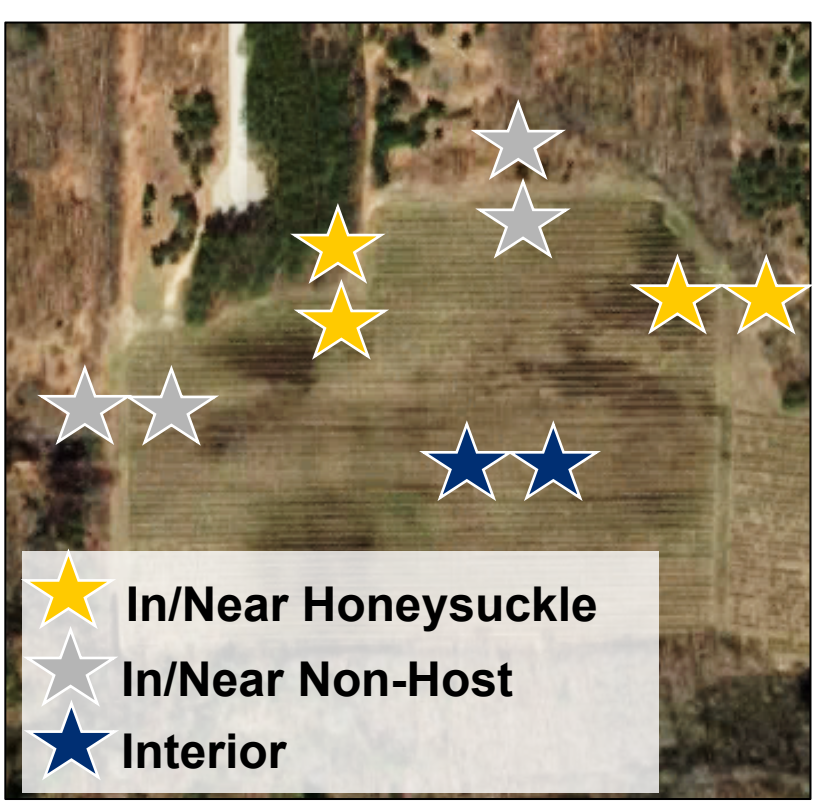
Parasitoids will be released at border edge and other refugia

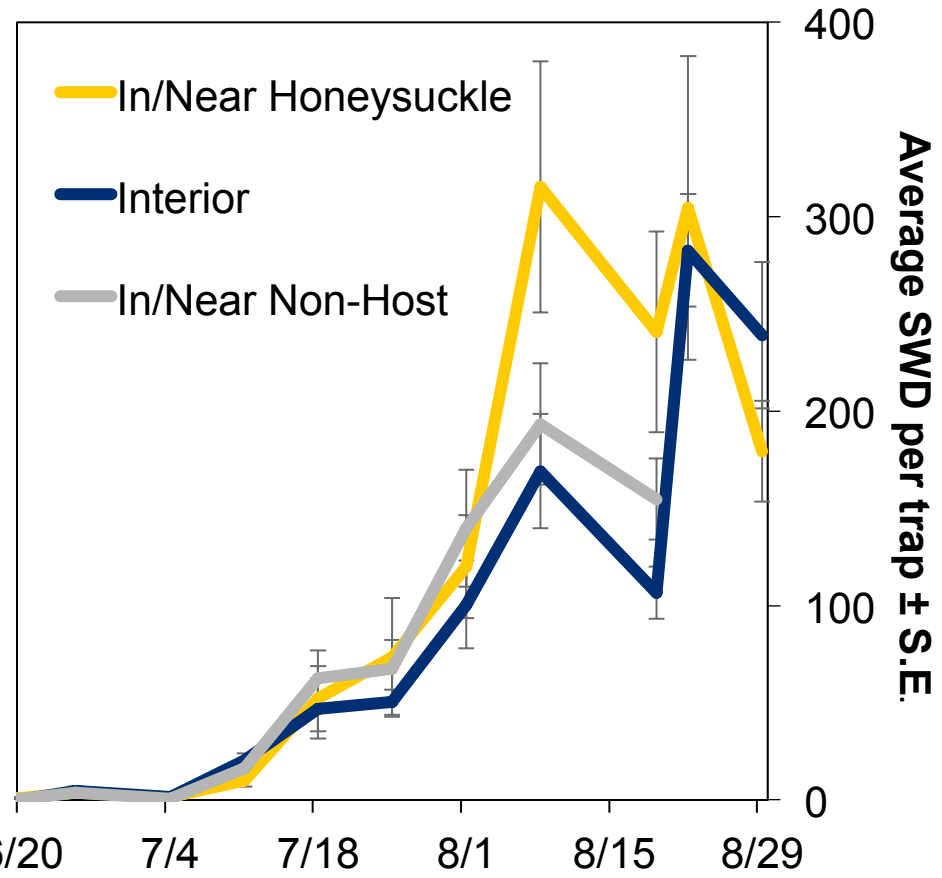
Chemical applications and other controls within crops should continue

SWD found in wild hosts



Honeysuckle increases SWD activity at crop edge





Summary

Local natural enemies were evaluated for their ability to attack SWD

They are not likely to keep SWD below an economic threshold

Five parasitoids species from Asia have been evaluated for release

Summary

A permit has been submitted for two larval parasitoids

If approved, release of these parasitoids should happen in 2018

Release will be focused in non-crop areas

Search for new parasitoids in Asia will continue

Ganaspis brasiliensis

Leptopilina japonica

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Questions?
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