Food for Thought

Nutritional supplements to boost biocontrol

Felix Wackers
Director R&D
Biobest Groep

biobest®
SUSTAINABLE CROP MANAGEMENT

- 304 AD: Chinese use biocontrol (ants) in citrus
- 1927: First use of *Encaria formosa* in greenhouses
- 1967: First production of *Phytoseiulus persimilis*
- 2010: 230 predators/parasitoids used in augmentative BC

New approach:

Using smart tools to make biocontrol agents better

This man is fast...

This man is faster

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Using smart tools to make biocontrol agents better

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BC agents have multiple resource requirements

- Overwintering sites
- Shelter
- Oviposition sites
- Alternative prey
- **Non prey Food**

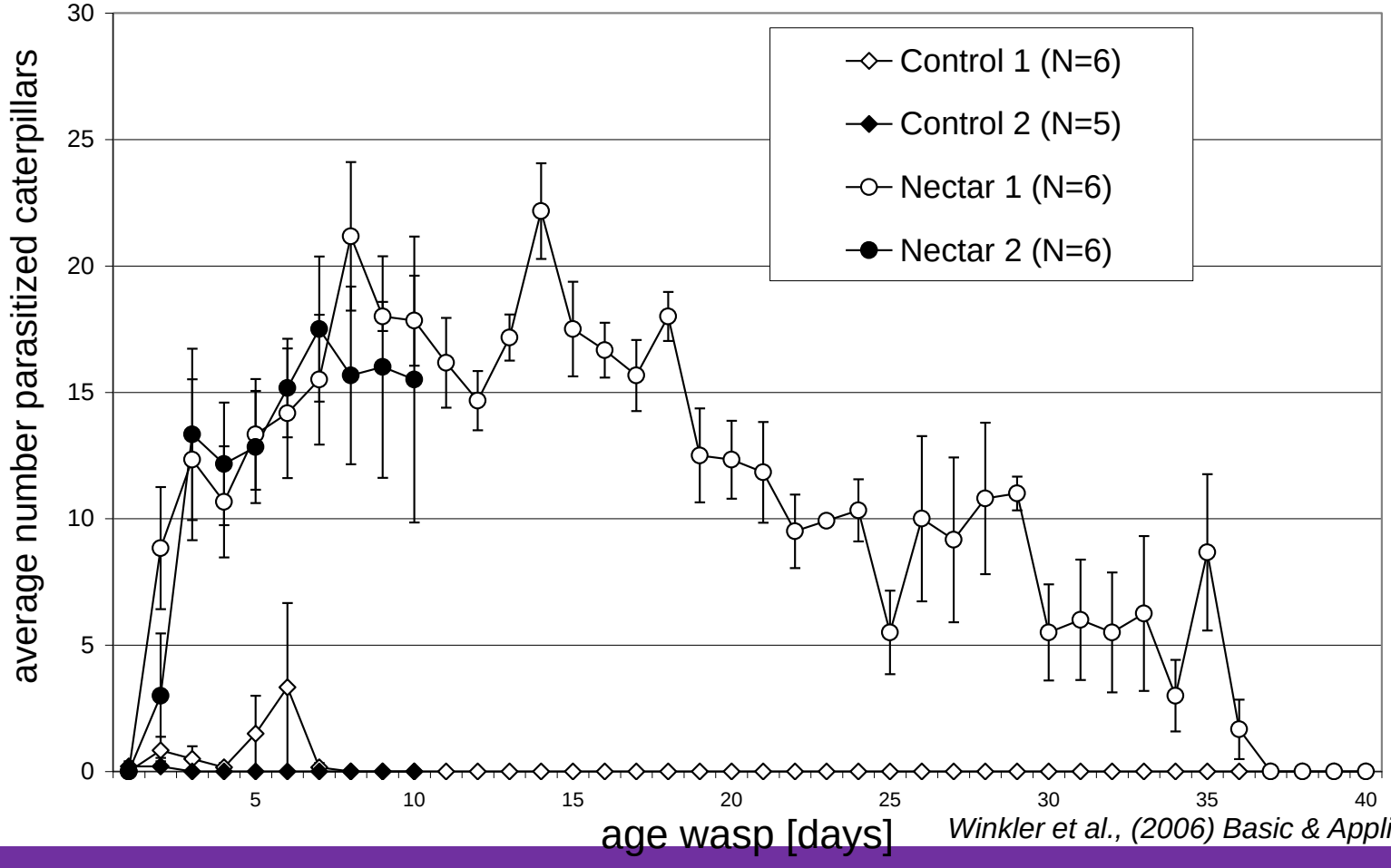
Augmentative Biol. Control

Predators and Parasitoids are Omnivores

Bottleneck:

Lack of nectar and pollen in many cropping systems

Impact of floral resources on biocontrol efficacy



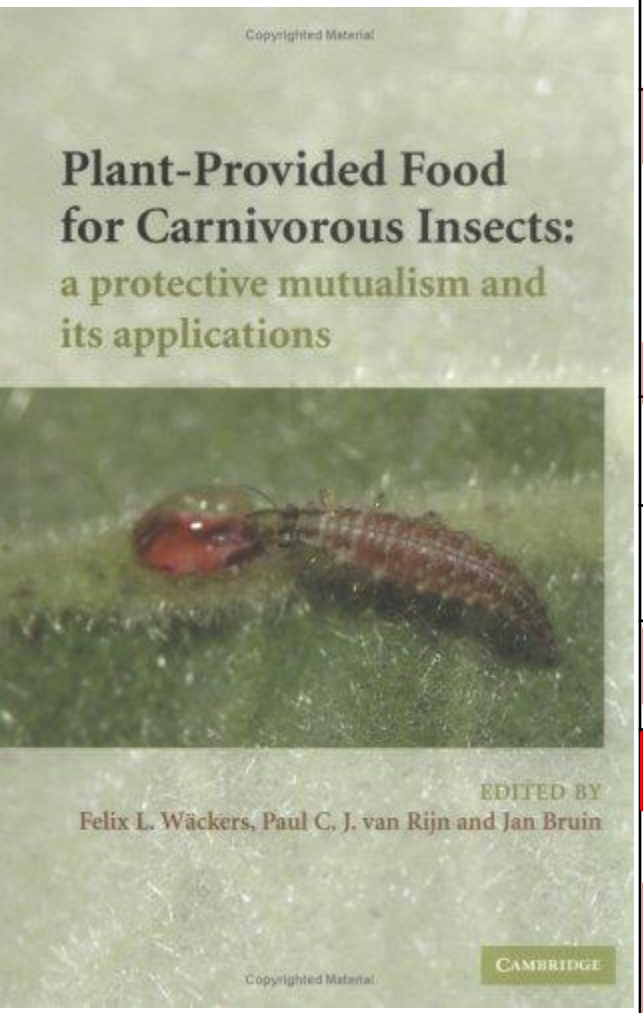
Winkler et al., (2006) Basic & Applied Ecol. 7:133-140

Feeding Predators?

Sugars/ Nectar

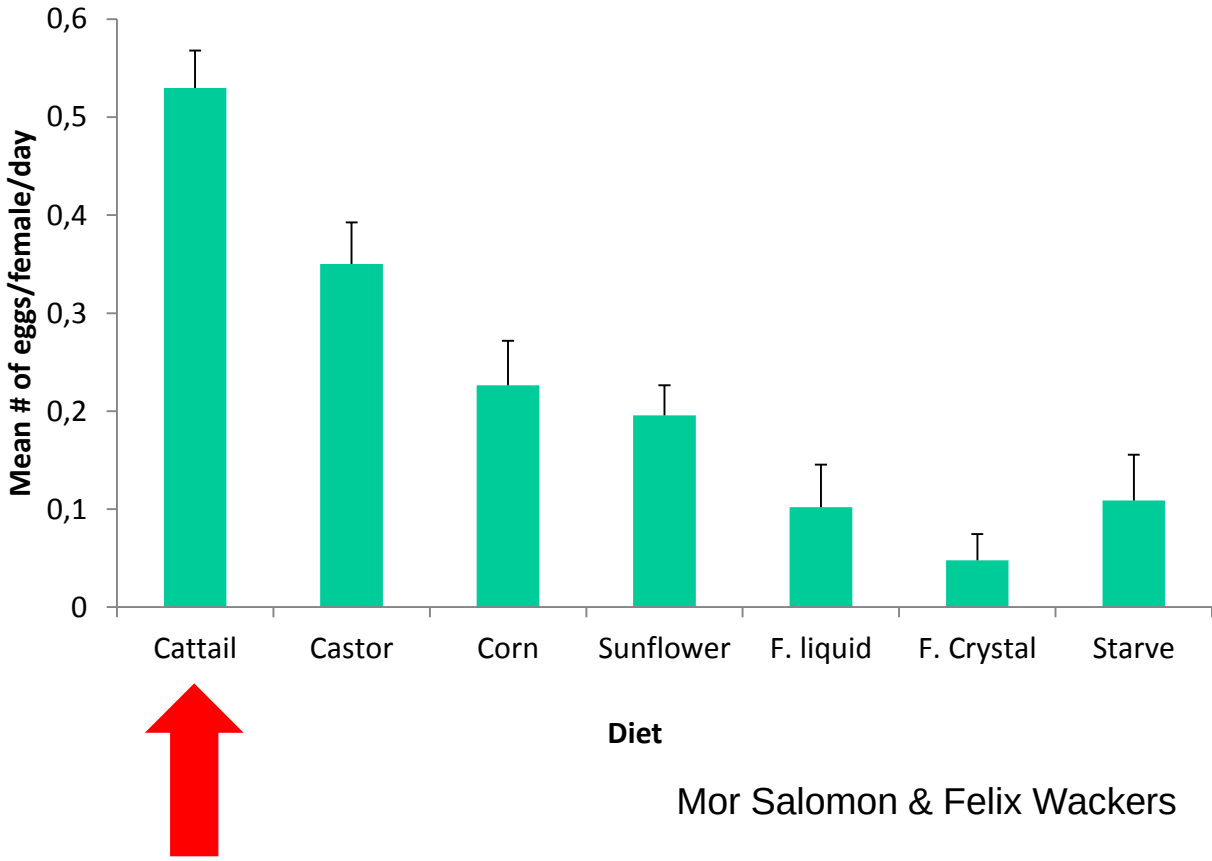
Pollen

Many predators are pollen feeders



Type	Plant-feeding stage	Arthropod examples can be found within:		Type of plant food utilised
Life-history omnivory	adult	Neuroptera:	Chrysopidae (green lacewings)	nectar, pollen
		Diptera:	Syrphidae (hoverflies)	nectar, pollen
		Hymenoptera:	Cecidomyiidae (gall midges)	nectar
			Tachinidea (parasitoid flies)	nectar
			Ichneumonidae, Braconidae, a.o. (parasitoid wasps)	nectar
			Vespidae (social wasps)	nectar, fruit
			Formicidae (ants)	nectar
		Coleoptera:	Meloidae (blister beetles)	nectar, pollen
	juvenile	Heteroptera:	Pentatomidae (stink bugs)	plant-juice
Temporal omnivory	adult	Hymenoptera:	Ichneumonidae, Braconidae, a.o. (host feeding parasitoids)	nectar
		Coleoptera:	Cicindelidae (tiger beetles)	seeds
	juvenile	Araneae:	Araneidae (orb web spiders)	pollen
Permanent omnivory	adult & juvenile	Acari:Mesostigmat	Phytoseiidae (predatory mites)	nectar pollen
		Heteroptera:	Pentatomidae (stink bugs)	plant juice
			Miridae (mirid bugs)	plant juice
			Geocorinae (*big-eyed bugs*)	plant juice
			Anthocoridae (flower bugs)	pollen
		Neuroptera:	*Chrysopa*, Hemerobiidae (brown lacewings)	nectar, pollen
		Thysanoptera:	Aeolothripidae, Phlaeothripidae	leaves, pollen
			Coccinellidae (ladybirds)	nectar
		Coleoptera:	Carabidae (ground beetles)	pollen seeds

Suitability of various pollen species for *A swirskii*



Mor Salomon & Felix Wackers

Pollen for Plant Protection?
Promising, but not practiced

Pollen improves thrips control with predatory mites
Paul C.J. van Rijn1, Y.M. van Houten1,2 & M.W. Sabelis1

Abstract
To achieve permanent suppression of western flower thrips in cucumber repeated introductions of predatory mites are usually needed. This suggests that the resulting thrips population levels are too low to maintain a predator population. A solution may be to provide alternative food, such as pollen, to the predatory mites. Pollen, however, is also a food source for thrips. How pollen affects biocontrol of western flower thrips, has been tested experimentally by applying cattail pollen on cucumber crops on which either Amblyseius degenerans or A. limonicus was released. In these two experiments, the predator population increased faster, and the thrips population remained smaller, in the compartments with pollen than in those without pollen. Application of A. limonicus together with pollen even resulted in negligible fruit damage.

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Food for protection:
an introduction

FELIX L. WÄCKERS AND PAUL C. J. VAN RIJN

It has long been recognized that plants provide floral nectar and pollen to attract pollinators. In addition, plants also provide specific foods as part of a protection strategy. By producing extrafloral nectar or food bodies, plants attract predators that can act as bodyguards, clearing the plant of its antagonists. A wide range of arthropods with a primarily carnivorous lifestyle require plant-provided food as an indispensable part of their diet (Table 1.1). In some arthropod groups, the adult stages depend on nectar or pollen for survival and reproduction, whereas in other groups all stages feed on plant-provided food in addition to prey. Only recently have we started to appreciate the implications of non-prey food for plant–herbivore–carnivore interactions. Insight into these food-mediated interactions not only helps in understanding the functioning of multitrophic interactions in natural ecosystems, it also has direct implications for the use of food supplements in biological control programs. In this introductory chapter we first sketch a historical perspective on the topic of plant-provided foods. Subsequently, we present an outline of the book and briefly introduce the different chapters.

The scientific discovery of plant-provided foods

Nutrimite™ : First commercially available pollen selected to support predatory mites

Nutrimite™ characteristics

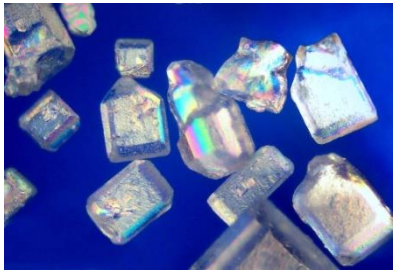
- Nutrimite has a well balanced nutrient profile

Protein	Starch	Other Carbs
20.6	30.6	18.9

- Nutrimite is relatively resistant to mould/high humidity
- Nutrimite is not collected by bees
- Nutrimite is not collected from a crop, so no issues with pesticide residues
- After application, Nutrimite keeps its nutritional value for up to two weeks
- Nutrimite is relatively unsuitable for thrips
- As the pollen grains are large, Nutrimite settles quickly and causes little allergy problems

Potential for Typha as food supplement

- **Use in combination with predator releases**
- Use by itself to enhance naturally occuring predators



Response of various predatory mite to Typha pollen

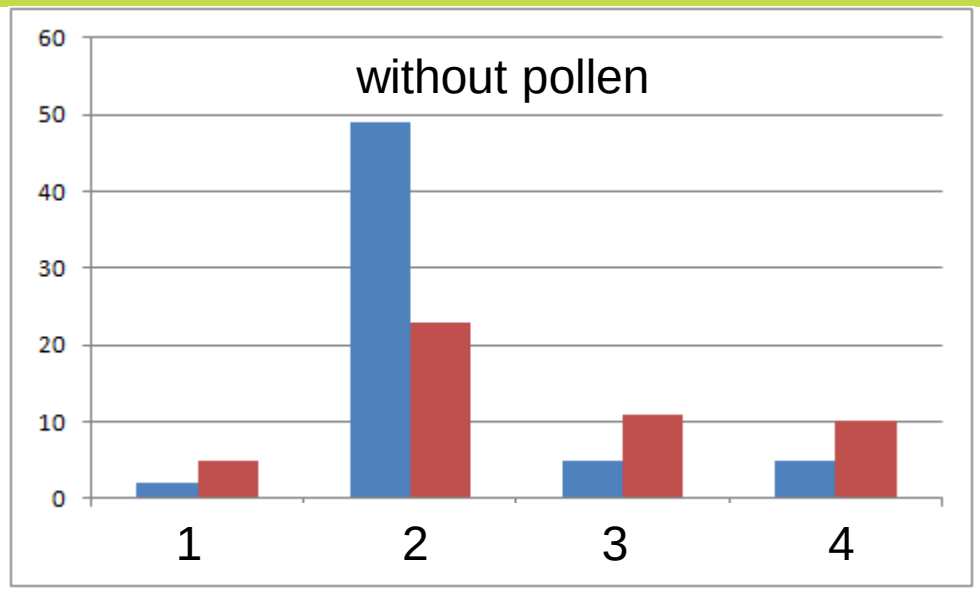
Predatory mite species	Prey	Response to Nutrimite
E. gallicus	Thrips and whitefly	+++++
A. degenerans	Thrips	+++
A. swirskii	Thrips and whitefly	++
A. andersoni	Spider mites and thrips	+
A. californicus	Spider mites	+/-
A. cucumeris	Thrips	-

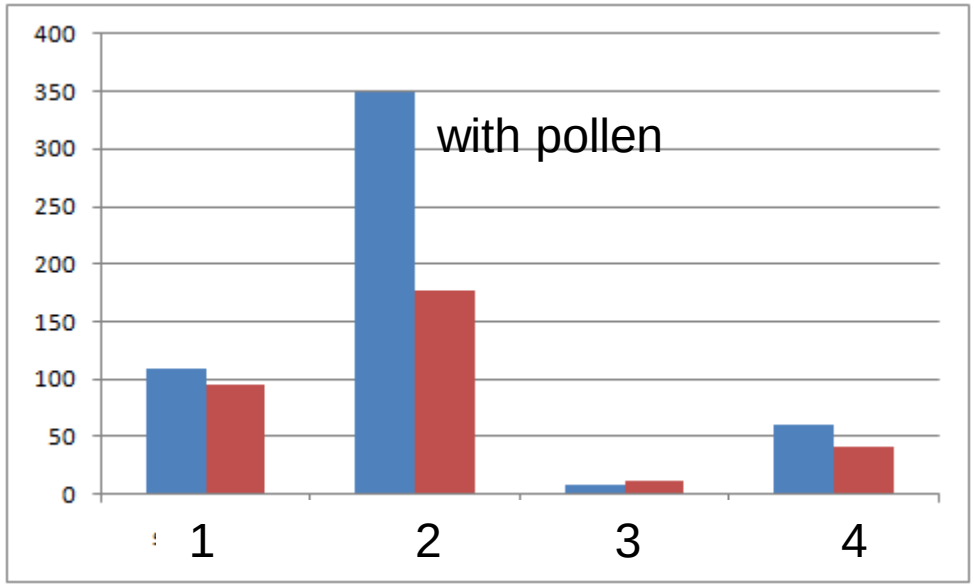
Comparison of predatory mite responses to Typha pollen
(number of mites per plant after 4 weeks)

Mobile stages

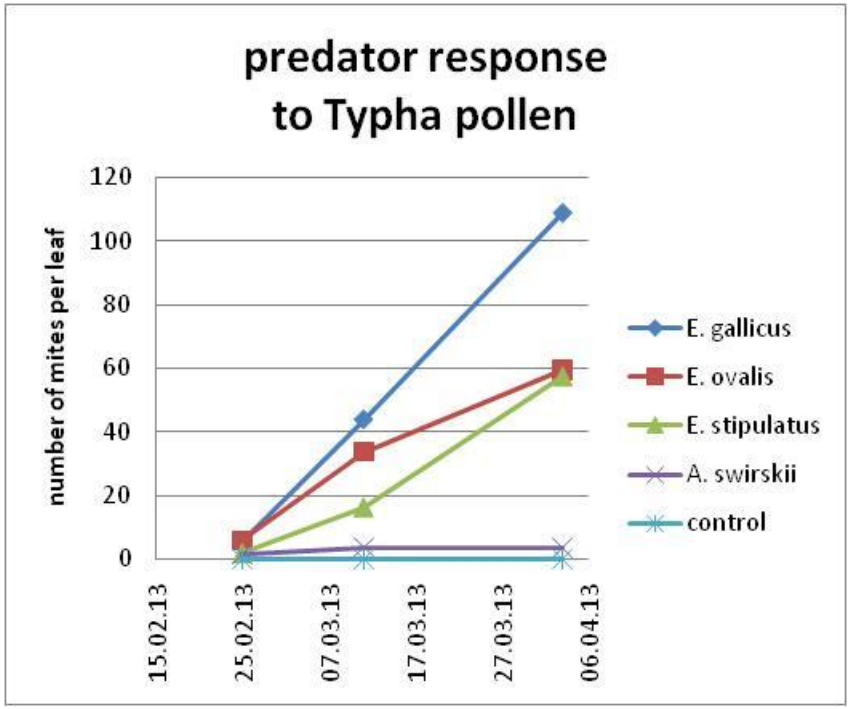
Eggs

2= *Euseius gallicus*
(Dyna-mite)



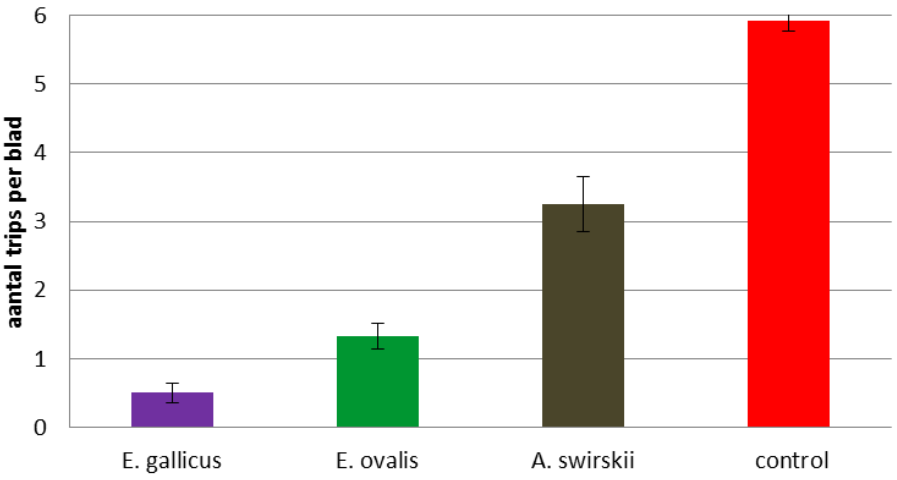


Comparison of predatory mite responses to Typha pollen

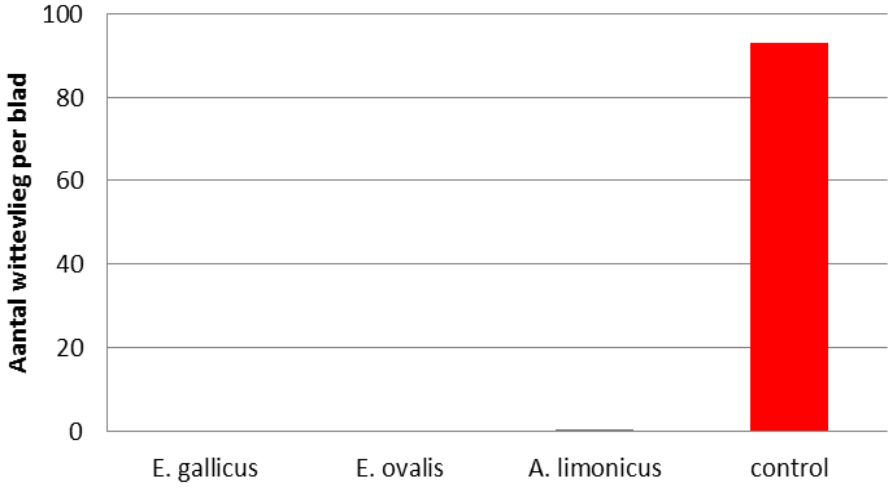


Impact on pest control

Thrips control



Whitefly control

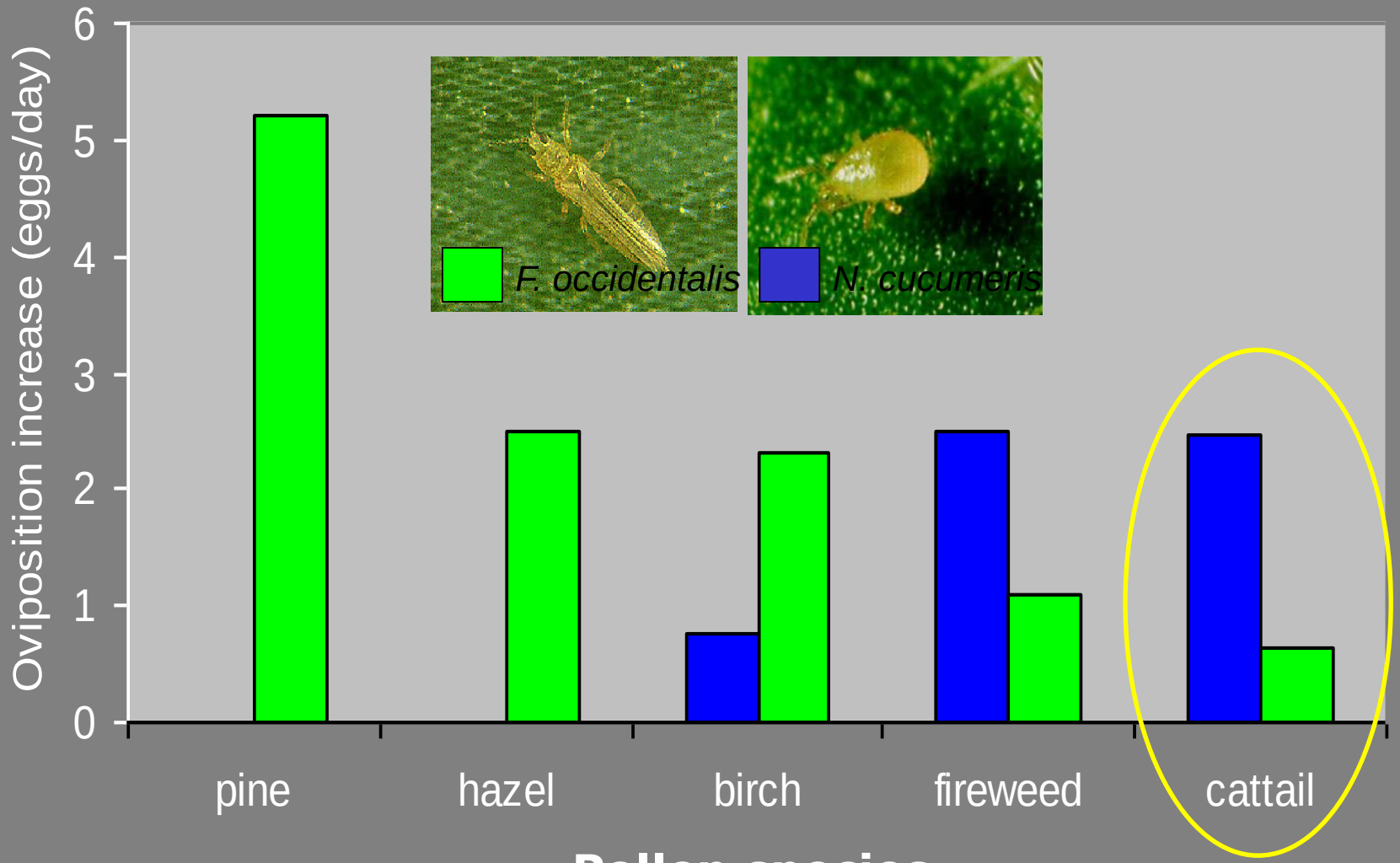


Comparison Dyna-Mite/A.swirskii

	Dyna-Mite (Euseius gallicus)	Swirskii
Controls	Thrips, White fly	Thrips, White fly
Intra-guild predation	Low	High
Min. Temp.	10ºC	15ºC
Mobility/Speed	+++	++
Response to Nutrimite	+++++	++

Avoiding thrips problems

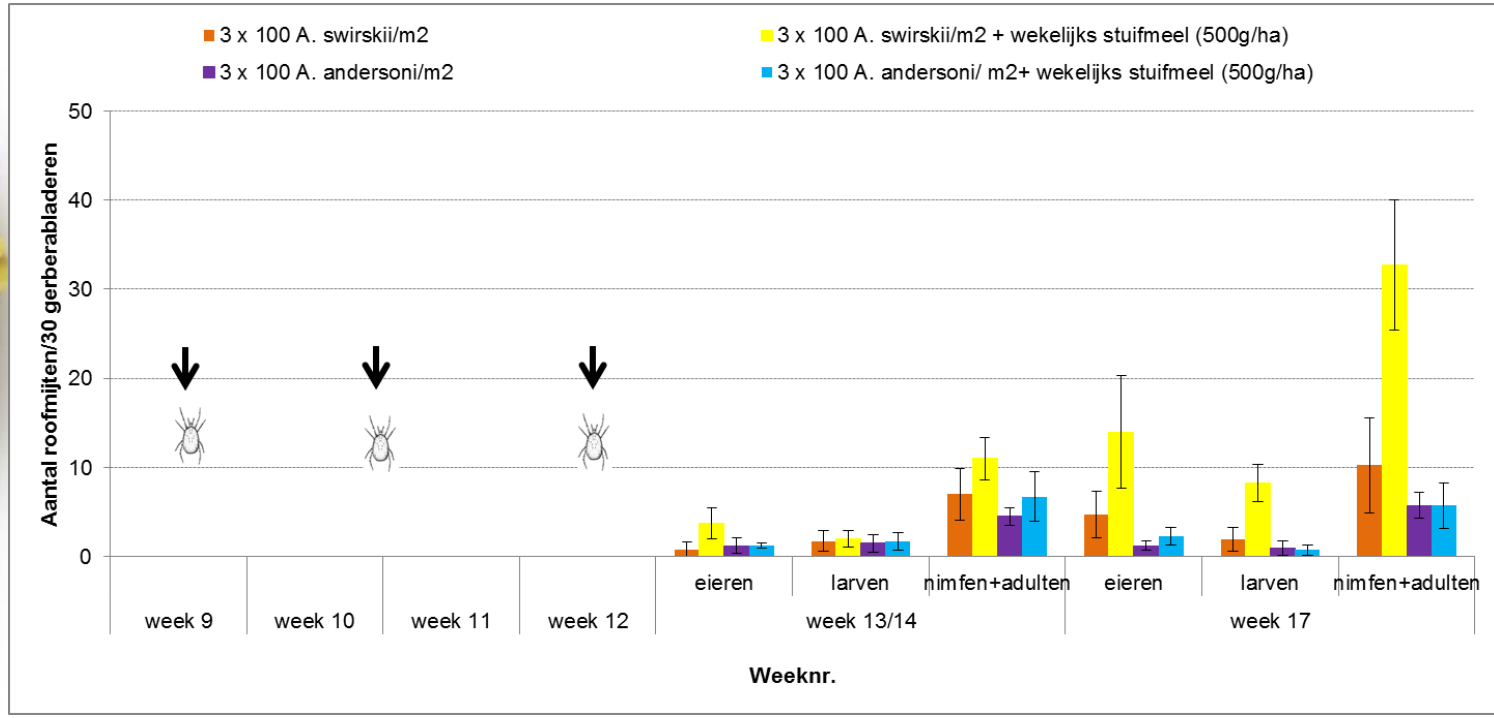
Nutrimite is good for predatory mites; not good for thrips



(Hulshof et al., EEA 2003)

(Van Rijn & Tanigoshi, EAA 1999b)

Commercial trials
Typha pollen/swirskii in Gerbera

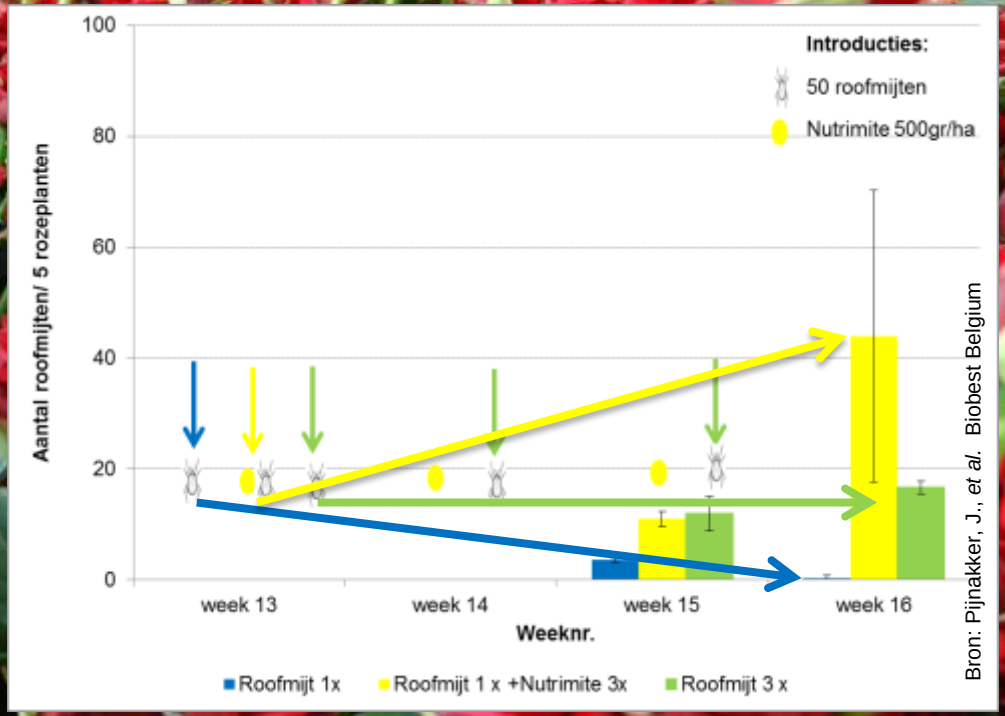


Commercial trials
Typha pollen/swirskii in Roses

Crop:
- Cut roses

Result:
- **2,5 times more** predatory mites **after 1 x swirskii** introduction **and 3 x Nutrimite**

  as compared to **3x swirskii** introductions!



Application

- Required for application: 500 g/ha
- Application time: 20 minutes/ha
- Pollen impact lasts for 2 weeks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Potential for food supplements

- Use in combination with predator releases
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RE-THINK

Thanks