Biological Control Strategies for Western Flower Thrips and Mites

Gerben Messelink, Wageningen UR Greenhouse Horticulture

Nursery/Floriculture Insect symposium,
Watson Ville, December 12, 2013

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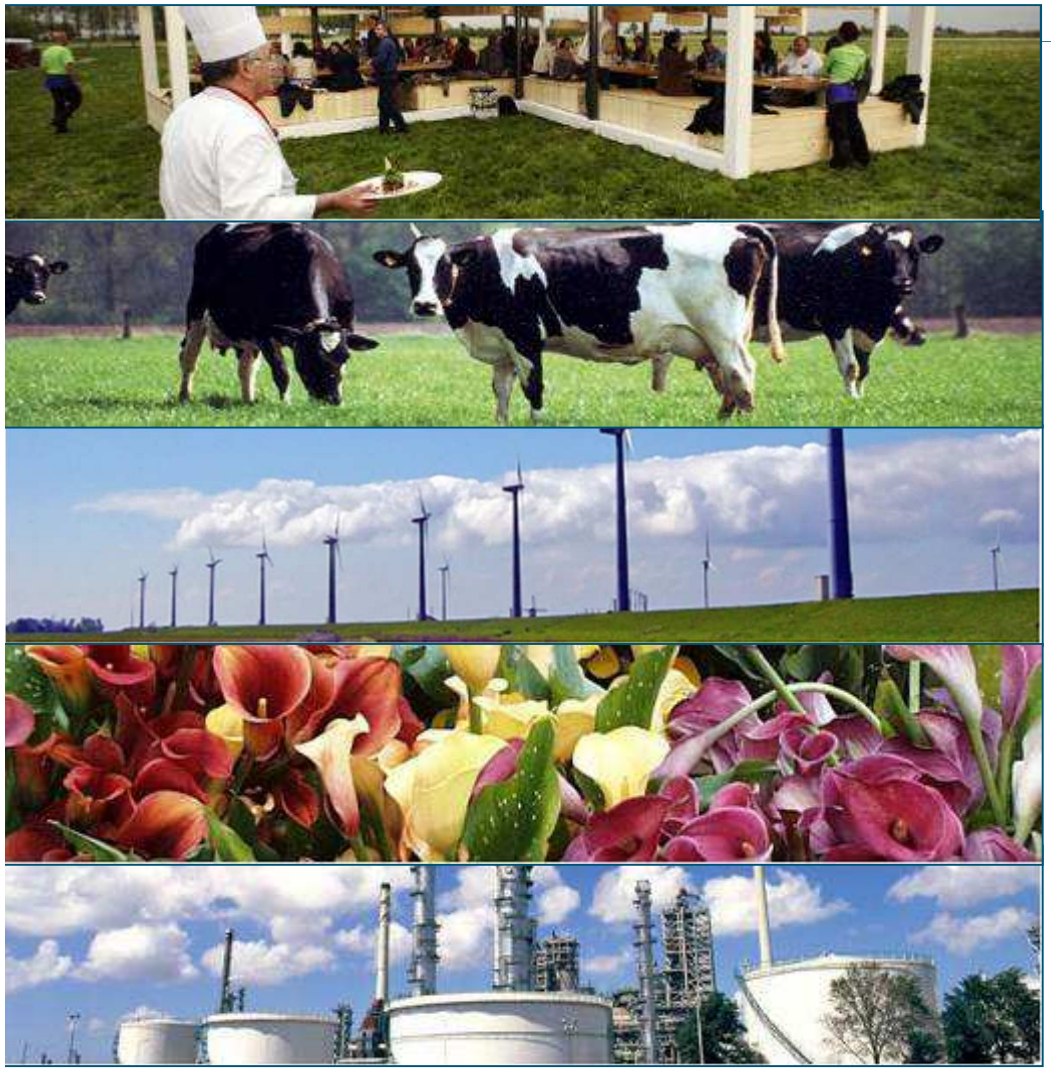
Wageningen University and Research Centre



Social Sciences Group

Animal Sciences Group

Environmental Sciences Group

Plant Sciences Group

Agrotechnology and Food Sciences Group

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Wageningen UR Greenhouse Horticulture

- Mission: Initiate and stimulate innovations for a sustainable greenhouse sector
- Strategic and applied research
- Staff: > 100 researchers

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Location: Bleiswijk

- 90 greenhouse compartments
- Crop protection laboratories
- Test facility taste of products
- Innovation and Demonstration Centre Greenhouse as Energy Source

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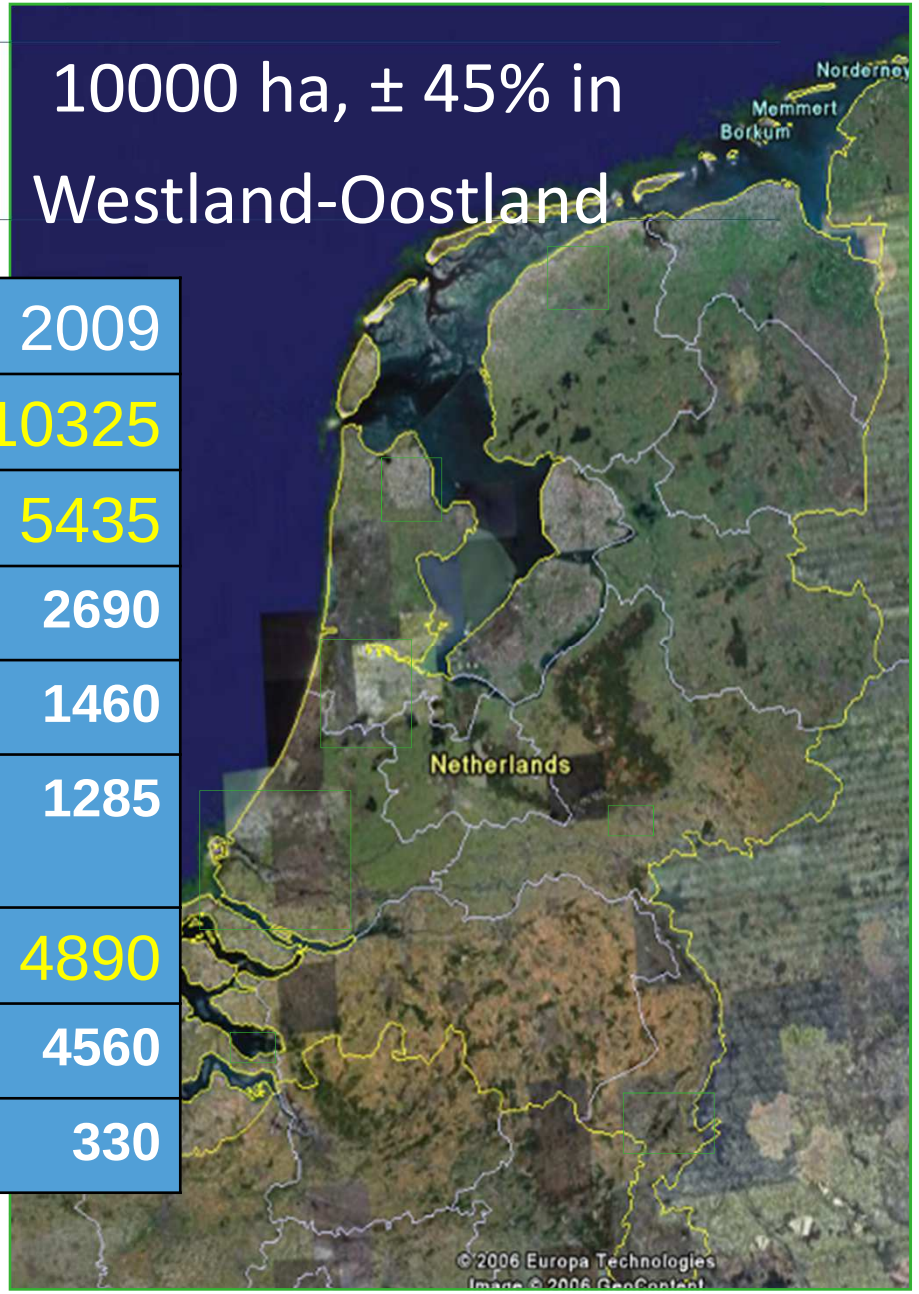
Greenhouse area:

	2009
Total area (ha)	10325
Floriculture	5435
Cut flowers	**2690**
Potplants	**1460**
Other (eg. gardenplants)	**1285**
Food	4890
Vegetables	**4560**
Fruit	**330**



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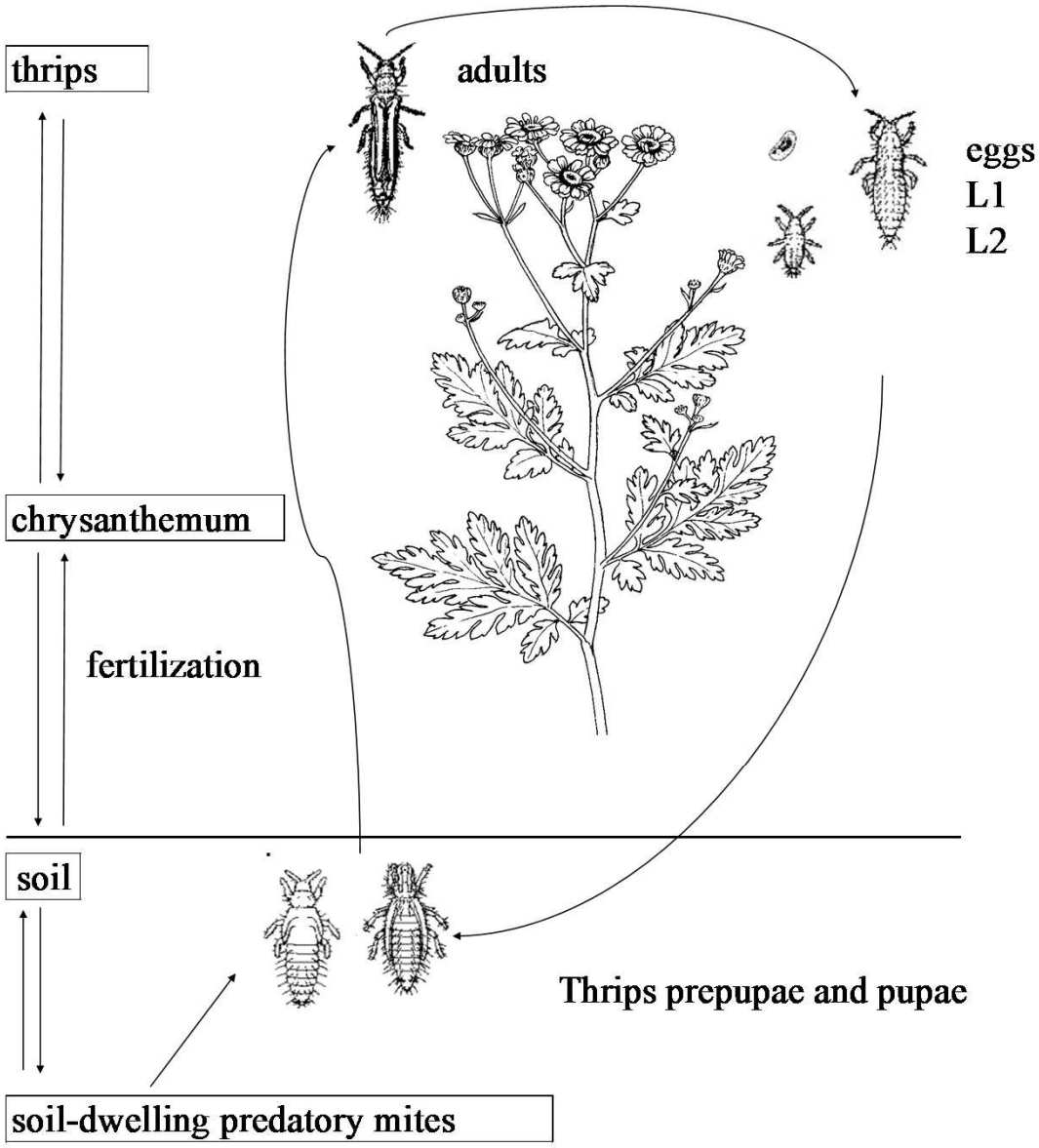
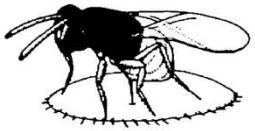
Damage caused by thrips

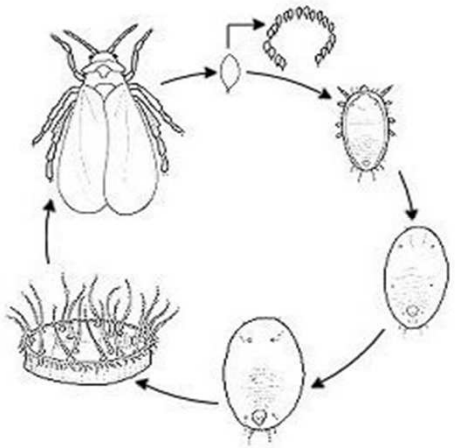

thrips
adults
eggs
L1
L2
chrysanthemum
fertilization
soil
Thrips prepupae and pupae
soil-dwelling predatory mites

Options for biological control

stage	BioControl agent
eggs	unknown
Young larvae	Predatory mites (cucumeris, swirskii, limonicus, montdorensis)
Older larvae	Predatory mite limonicus, predatory bugs
pupae (in soil)	Soil-dwelling predatory mites, Staphylinid beetles, entomopathogenic nematodes, predatory fly larvae
Adult thrips	Predatory bugs, entomopathogenic fungi

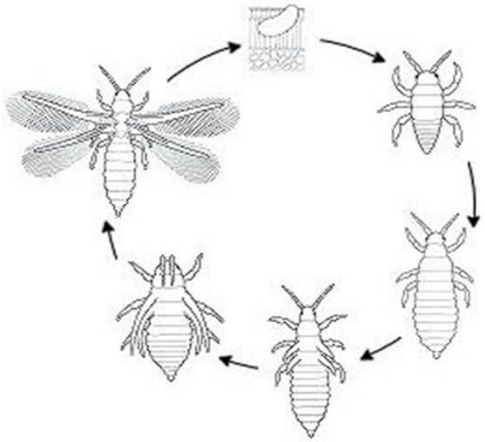
Encarsia formosa





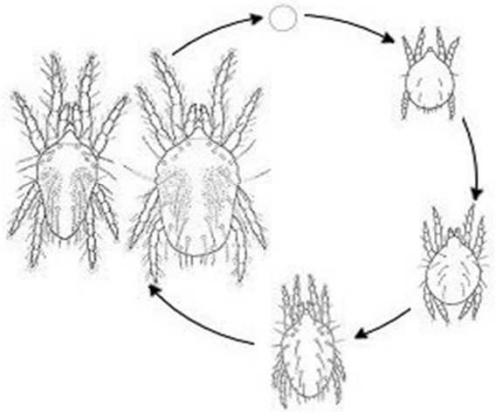
whiteflies

Neoseiulus cucumeris



thrips

Phytoseiulus persimilis



spider mites

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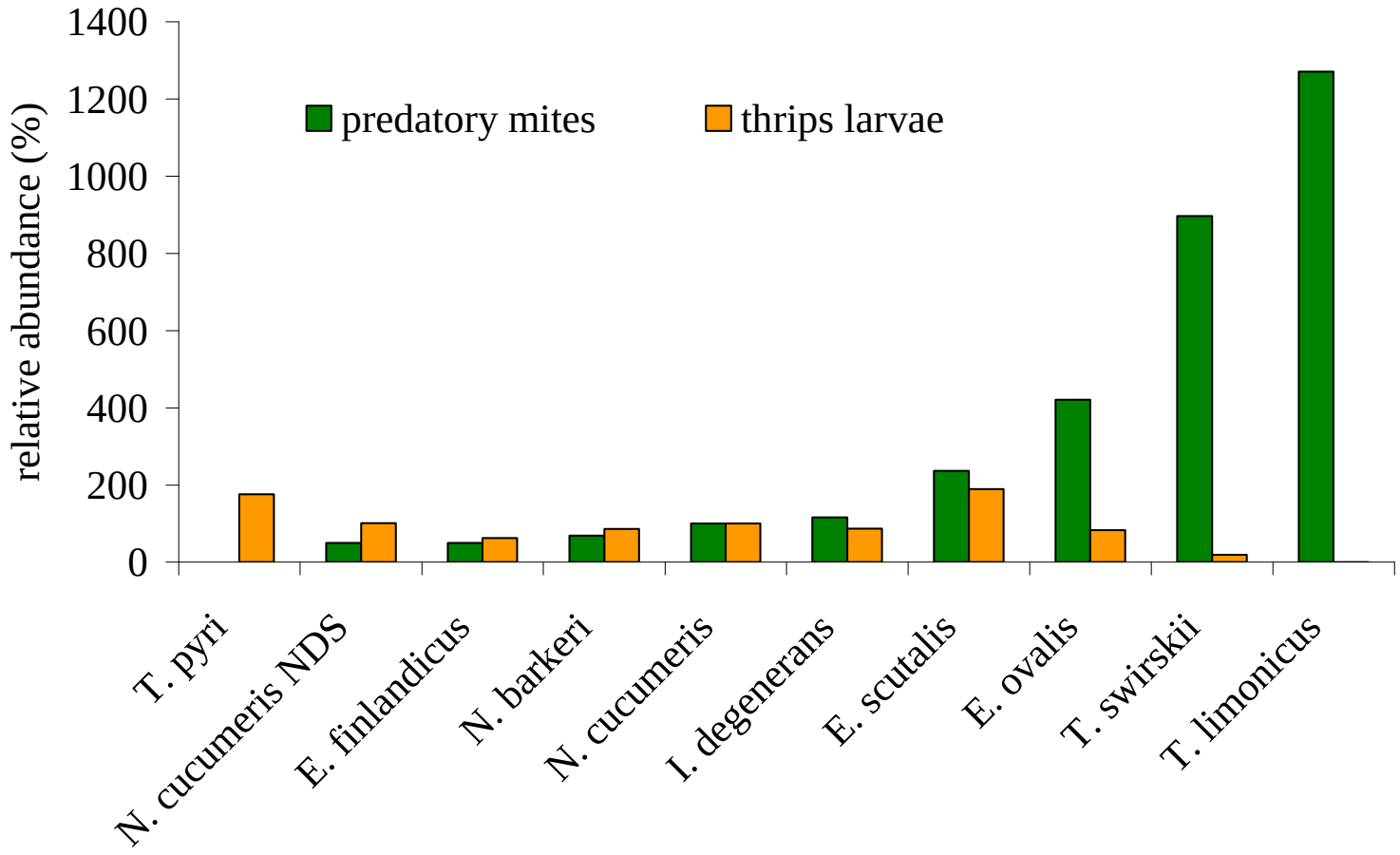
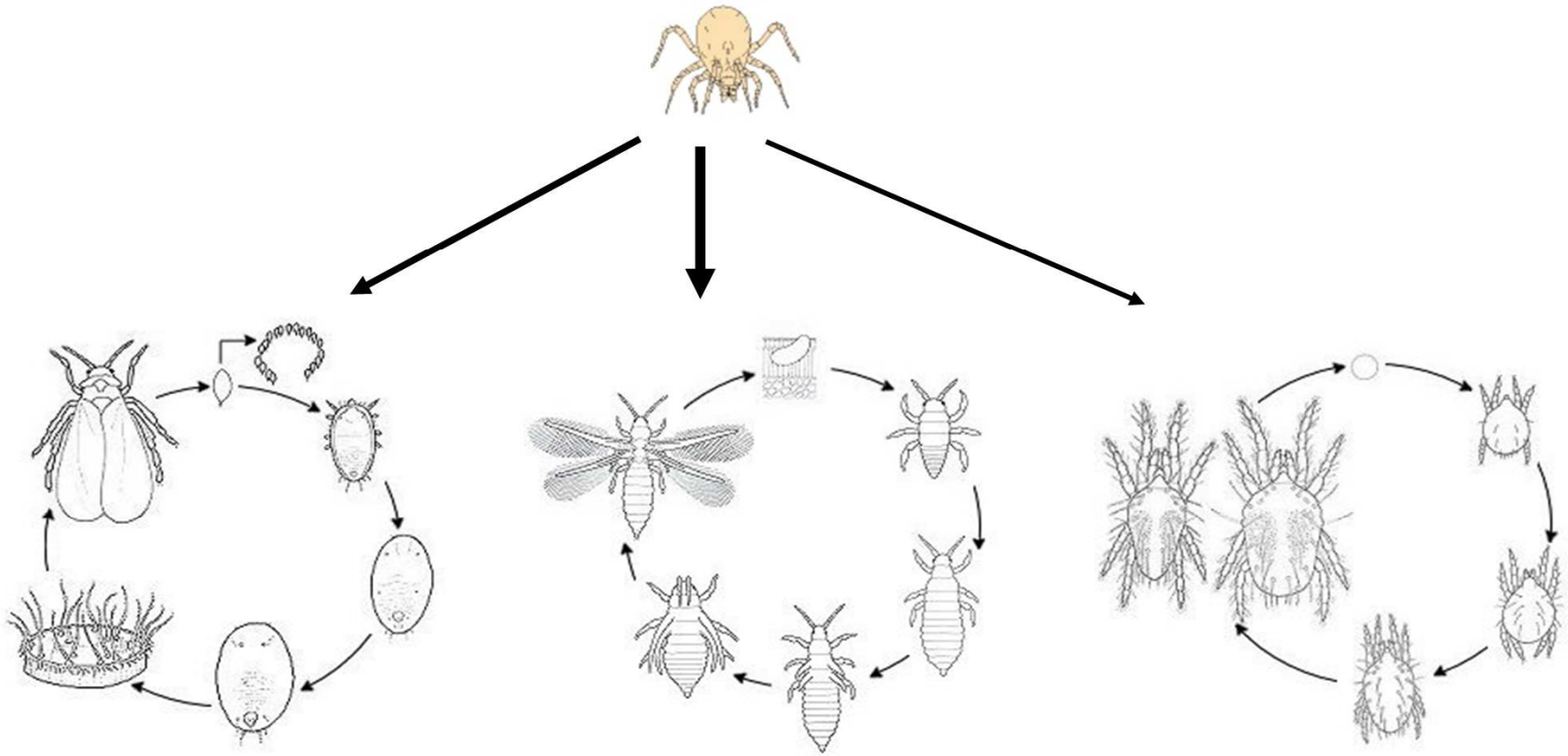
Evaluation phytoseiids on cucumber 2003



Generalist predatory mites



whiteflies

thrips

Spider mites

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Amblyseius swirskii feeding on whitefly eggs and thrips larvae

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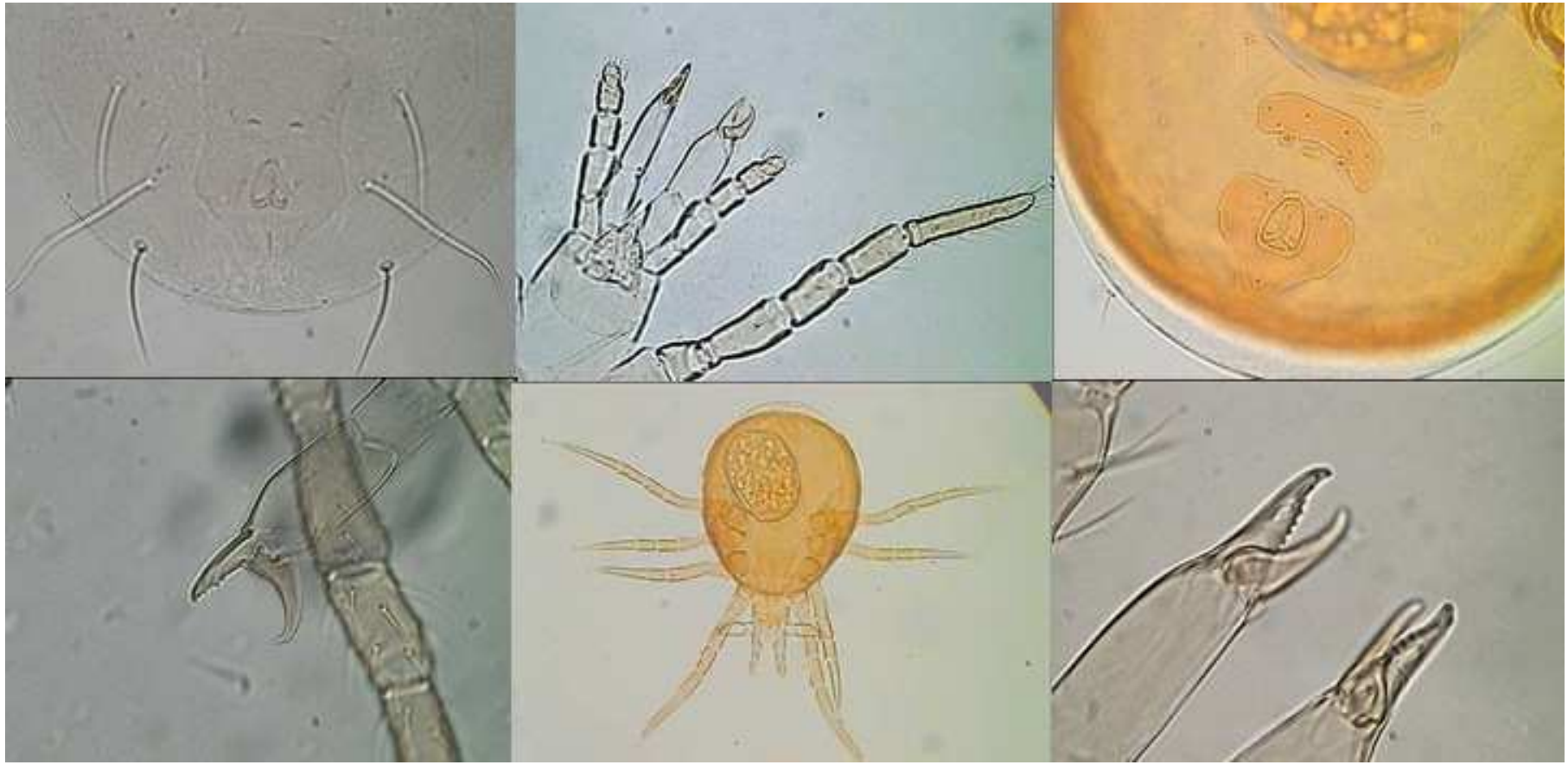
Variation in morphology of predatory mites



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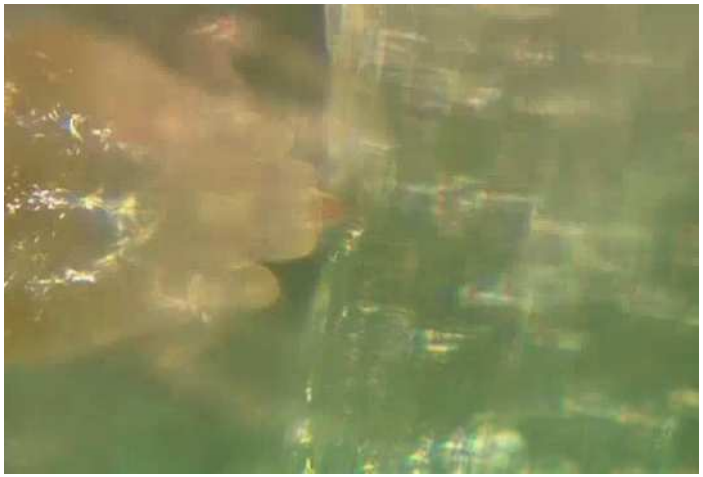
Selection should be based on both pests and plant traits

- Some predatory mites feed on plant tissue (depending on their morphology)!
- Differences in micro-climate
- Differences in plant provided food (nectar, pollen)
- Differences in numbers and diversity of prey



Dr. Palevsky, Israel

important plant traits


Euseius ovalis and *Euseius gallicus* perform well
in roses:
Due to plant + nectar feeding?

Selection of predatory mites for chrysanthemum

- 1000 predatory mites/plot of 7 m^2
- Follow in 6 crop cycles

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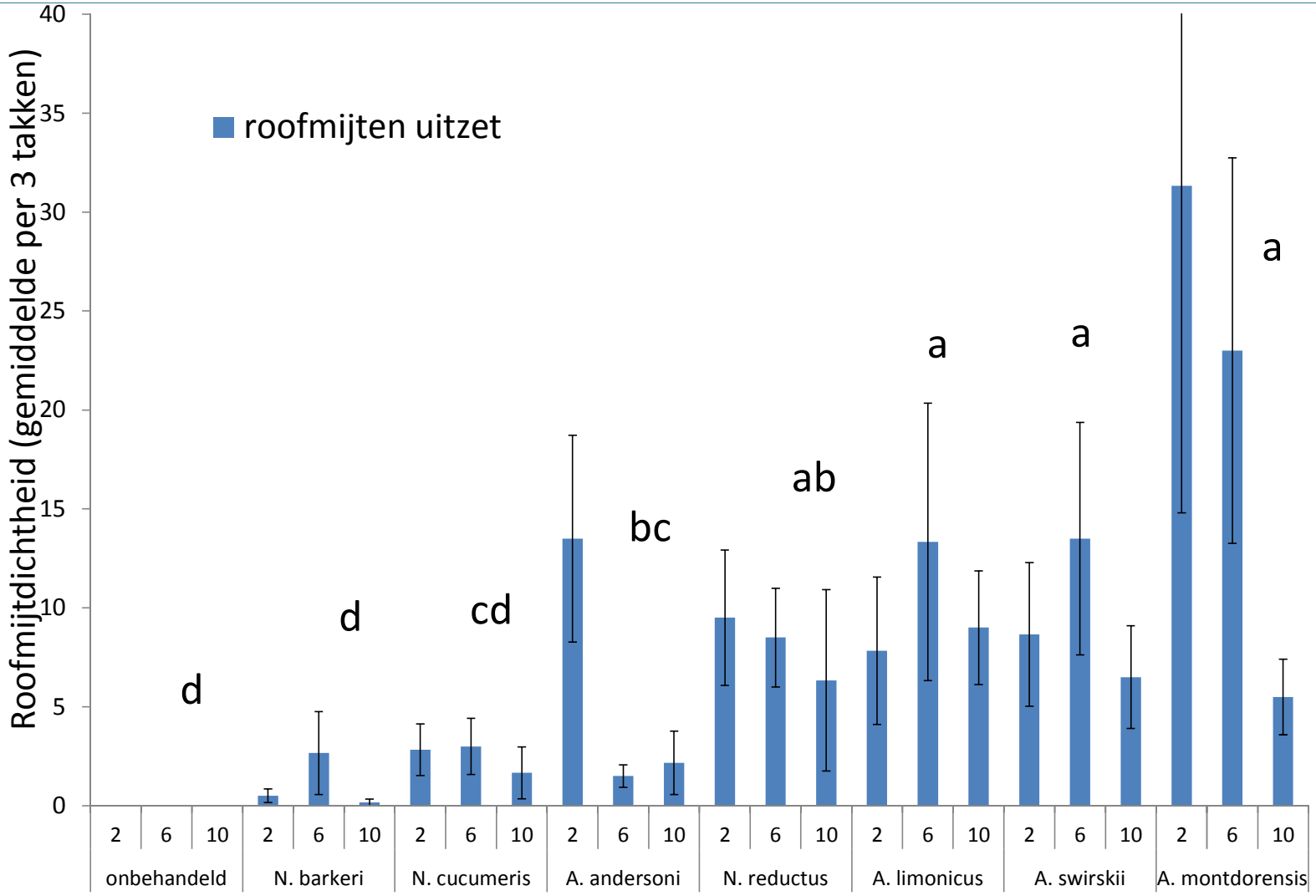
predatory mite densities



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Exploring the potential of soil-dwelling predatory mites:

Greenhouse survey's in 38 companies:

- 2002: 7x organic greenhouse vegetables
- 2005: 10x chrysanthemums
- 2006: 16x amaryllis
- 2007: 5x freesia's

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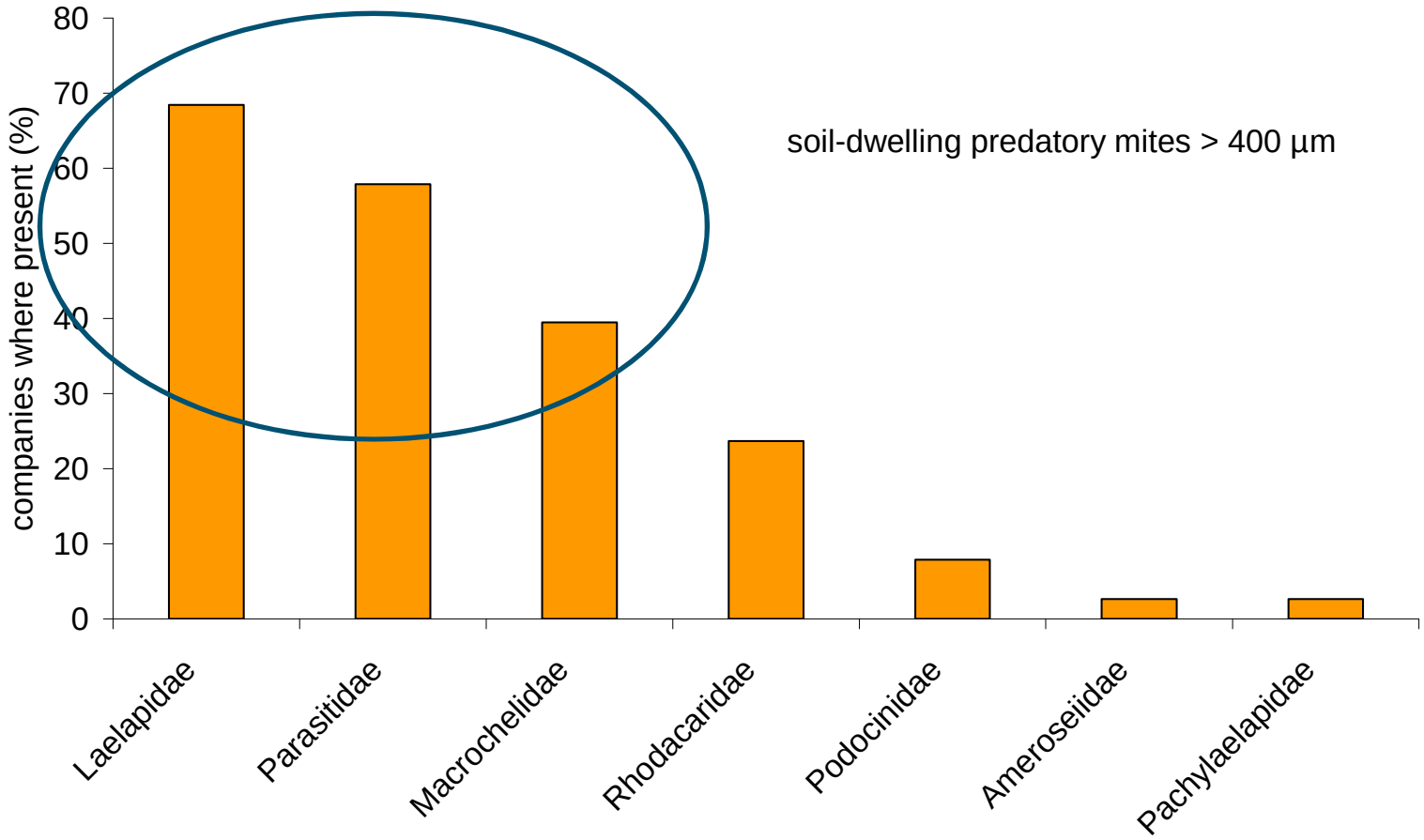
Results of survey's in Dutch greenhouses> 22 species

species	number of companies
Ameroseius corbiculus	2
Arctoseius cetratus	7
Hypoaspis aculeifer	10
Hypoaspis angusta	5
Hypoaspis miles	3
Hypoaspis spp.	8
Lasioseius fimetorum	2
Lasioseius sp.	1
Macrocheles robustulus	7
Macrochelus spp.	4
Macrochelus subbadius	3
Macrochelus vagabundus	1
Neoseiulus barkeri	7
Pachylaelaps imitans	1
Parasitus concors	1
Parasitus islandicus	3
Parasitus luminarissimilis	1
Parasitus spp.	17
Proctolaelaps pygmaeus	2
Proctolaelaps ventrianalis	1
Rhodacarus spp small	7
Rhodacarus spp. Large	9

Results of survey's in Dutch greenhouses



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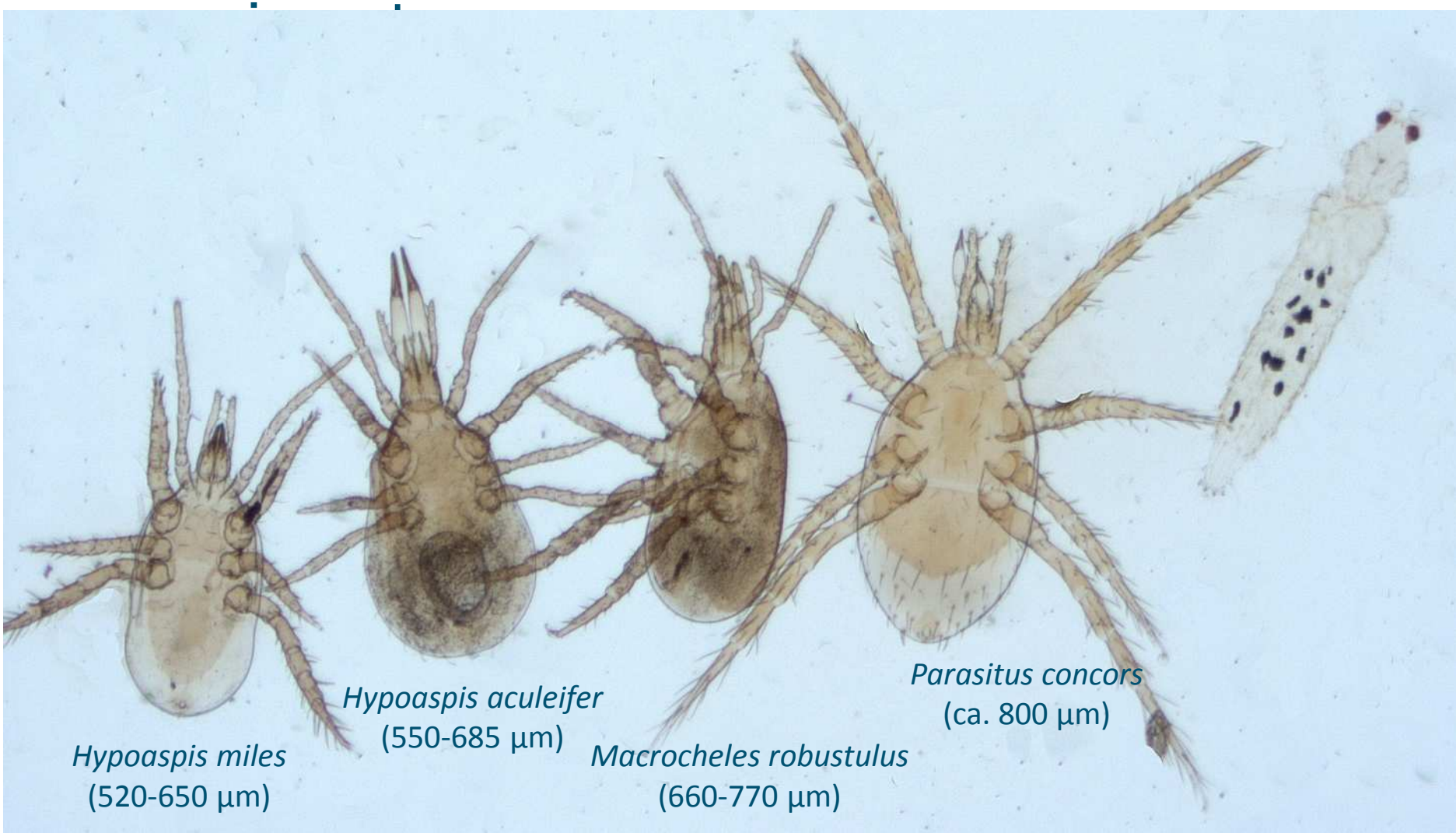
Species tested for laboratory predation



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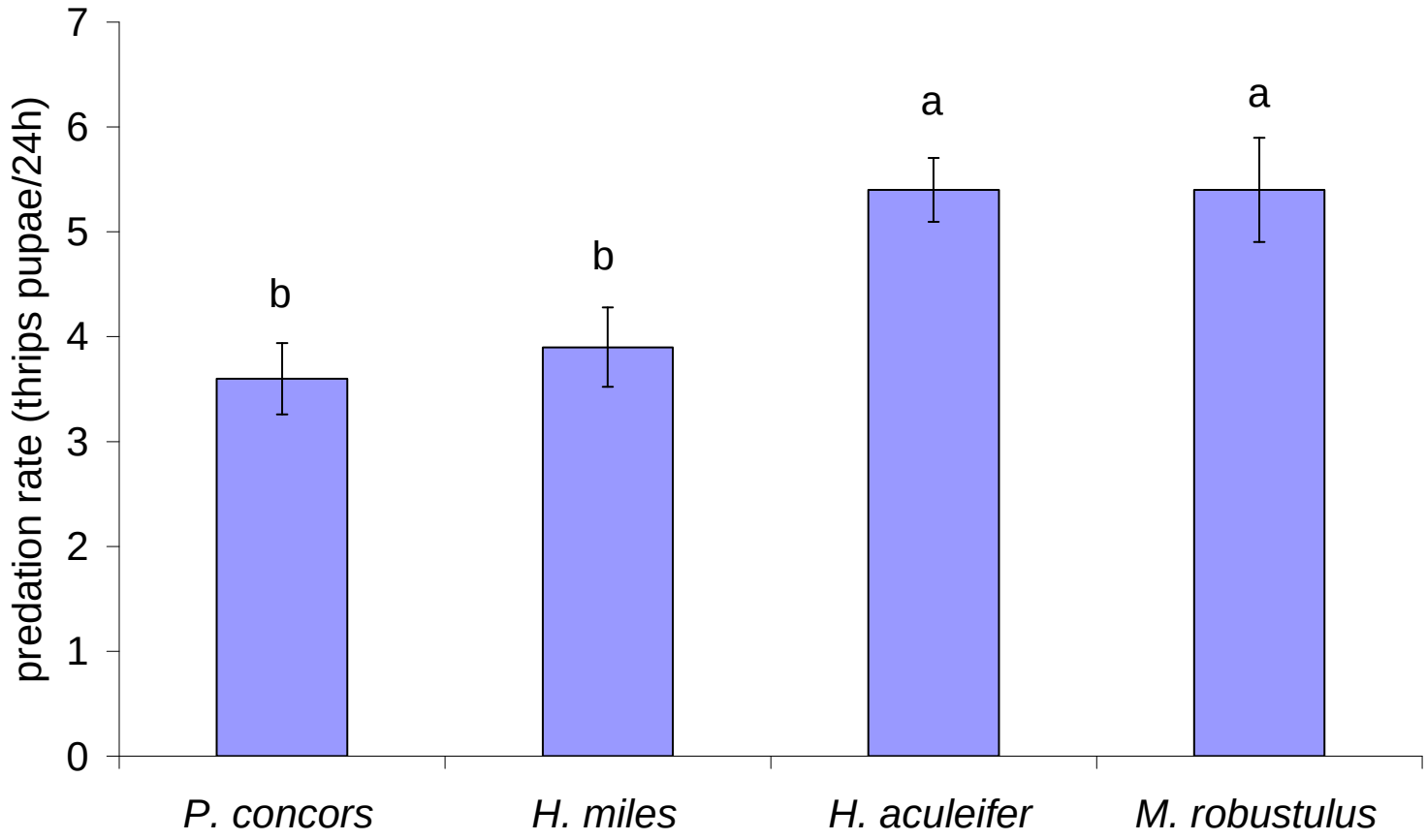
Predation rates of thrips pupae in the lab



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Macrocheles robustulus feeding on a thrips pupae

Assessing effects on thrips: cage experiments

- Chrysanthemum plants in cages
- Releasing 50 thrips females/cage
- After one week removing adults, adding soil-dwelling mites and a sticky plate
- After 4 weeks: collecting sticky plates and analyzing soil with Tullgren funnels

Assessing effects on thrips in cage experiments

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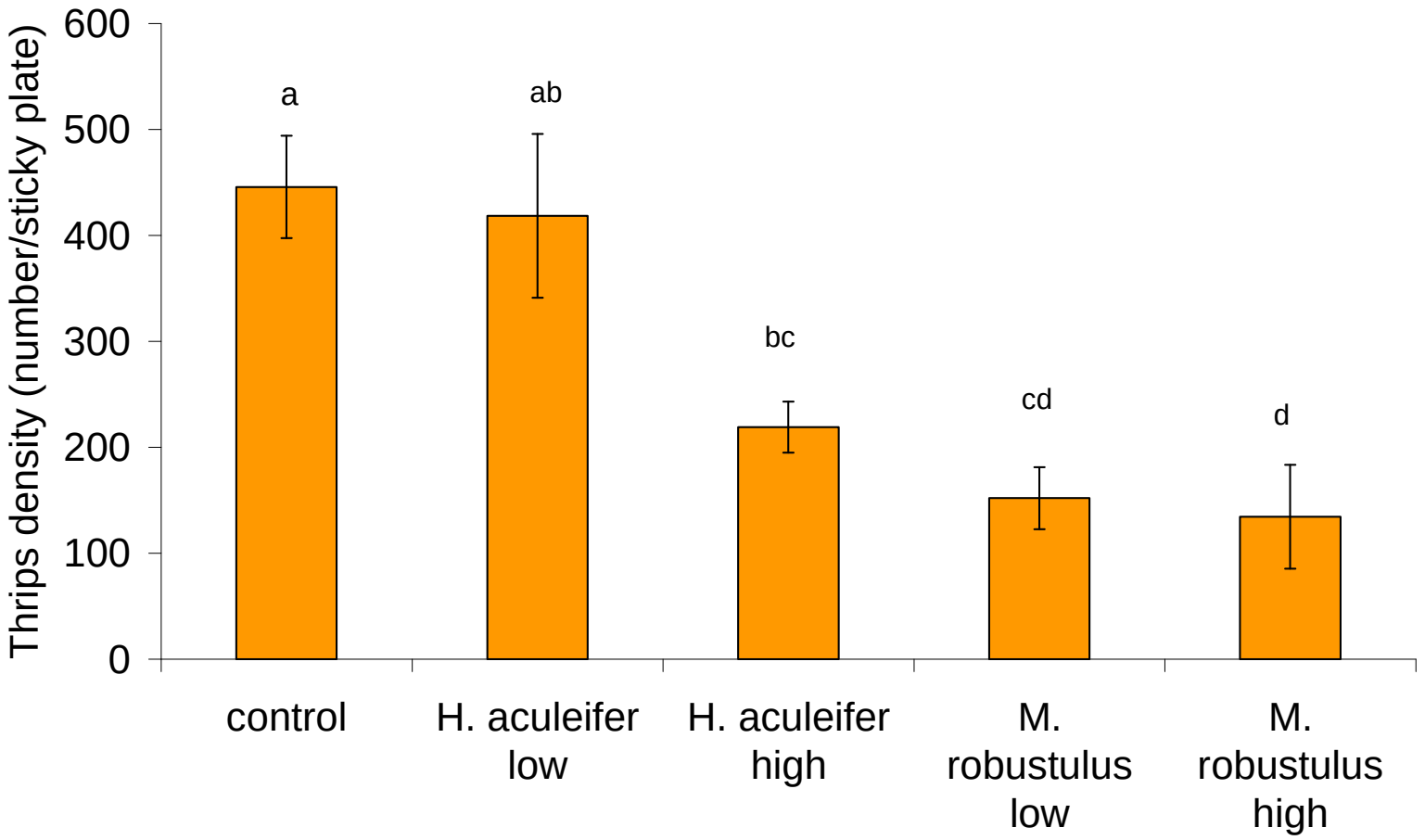
Results cage experiment



Other soil-dwelling predators

Larvae of *Coenosia attenuata*

Atheta coriaria

Control of adult thrips with Orius spp.

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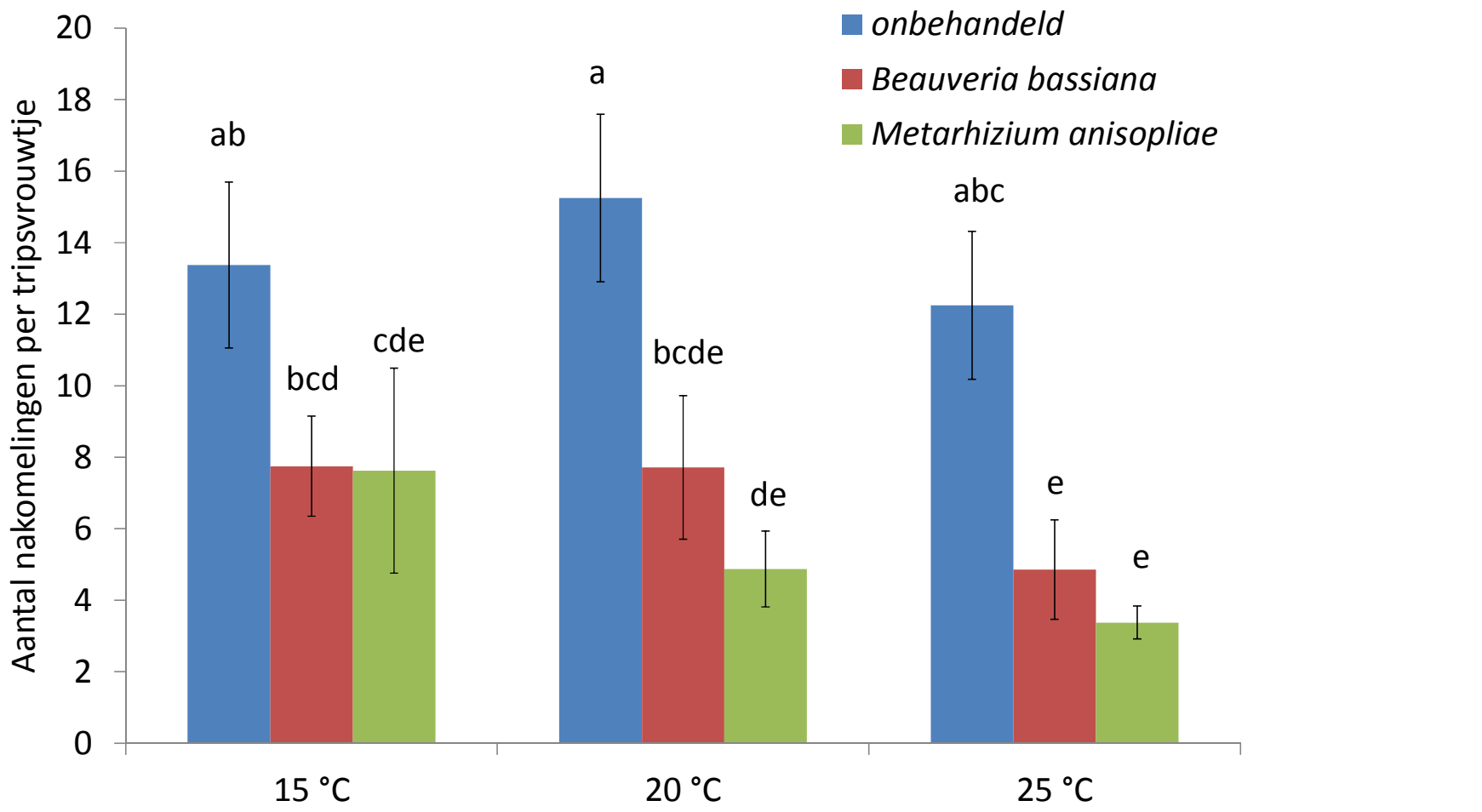
Control of adult thrips with entomopathogenic fungi

Reproduction after infection



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Project “Lure & Infect”

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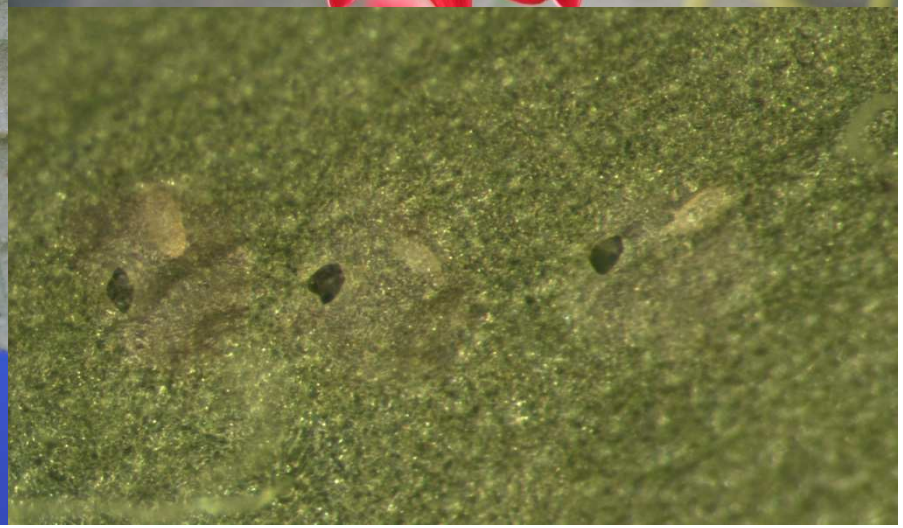
Tips & Tricks for controlling thrips

- Combine several biocontrol agents that target different stages of thrips
- Select the most suitable predatory mite for your crop depending on target pests, climate and food present
- Take preventive measures: establish populations of predators
- Be aware that efficacy of entomopathogenic fungi and nematodes strongly depend on humidity, thrips stage, and thrips behaviour

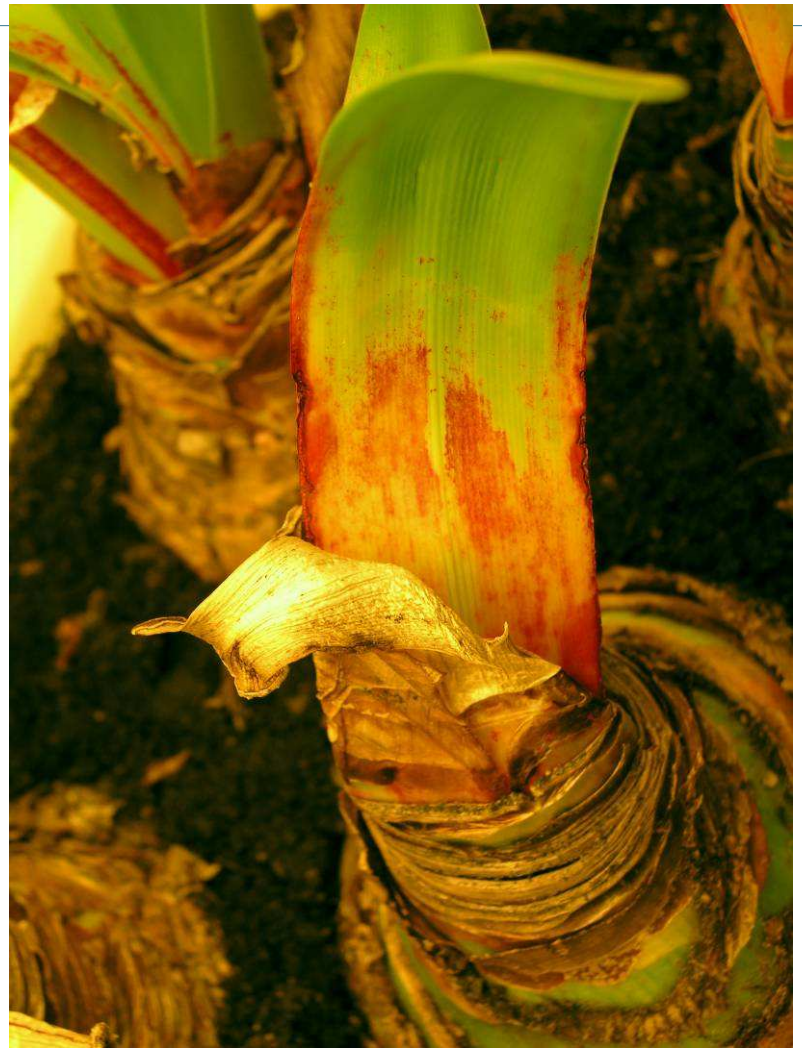
Spider mites and tarsonemid mites




Specialist predator: *Phytoseiulus persimilis*

Mites in amaryllis

The bulb scale mite: *Steneotarsonemus laticeps*



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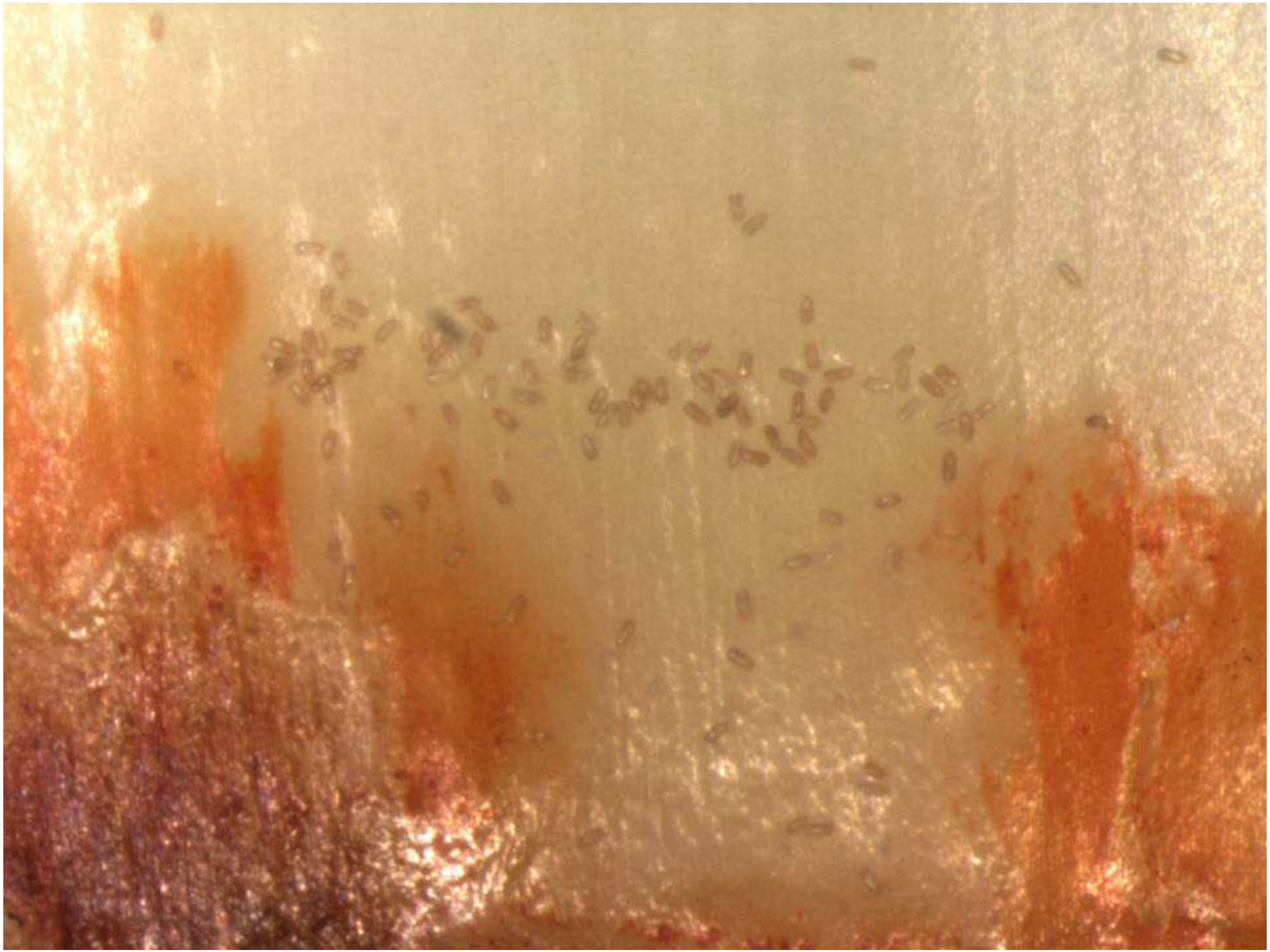


The bulb scale mite: *Steneotarsonemus laticeps*

Some facts:

- Very tiny tarsonemid mite (200 µm)
- Causing red decoloration, growth inhibition, flower deformation
- Ca. 90 % of the amaryllis nurseries are contaminated
- Easily overlooked
- Control based on chemicals
- Little knowledge from literature

Options for biological control

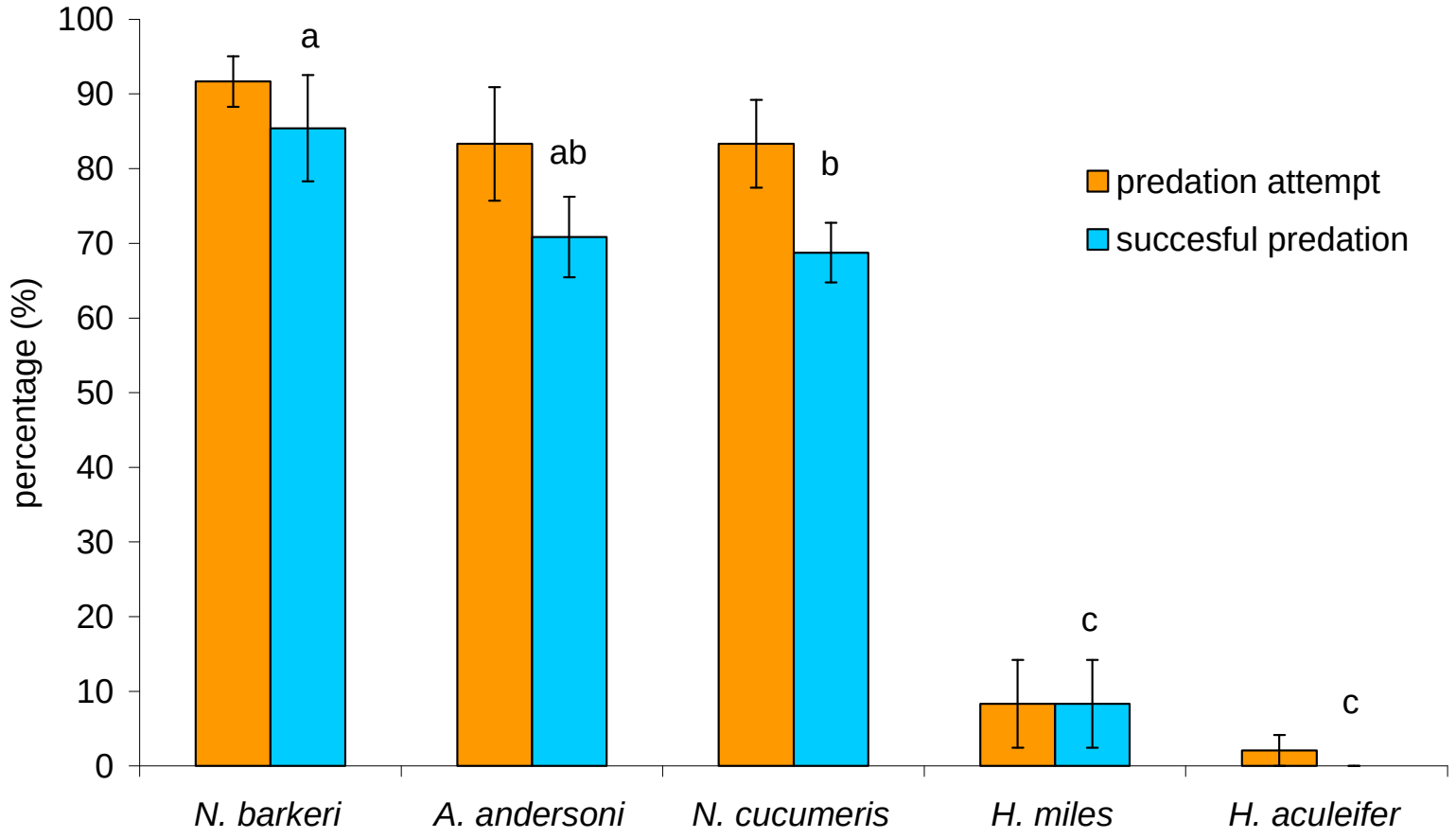
- Phytoseiid predatory mites do have potential for biological control (successes with other tarsonemid mites)
- Mass releases of *Neoseiulus cucumeris* not succesful in amaryllis (IPM-project)
- Soil-dwelling predatory mites (Hypoaspis) are suggested

Greenhouse survey of 15 amaryllis nurseries

predatory mite species	size (µm)*	number of nurseries where observed	location in plant		
			roots and soil	bulb	leaves
Proctolaelaps ventrianalis	260 – 285	1	x	x	
Rhodacarus sp.(small)	300	3	x	x	
Arctoseius cetratus	310 – 360	1	x		
Proctolaelaps pygmaeus	345 – 410	2	x	x	
Neoseiulus barkeri	350 – 380	7	x	x	x
Ameroseius corbiculus	450	1	x		x
Lasioseius sp.	450	1	x		
Hypoaspis miles	520 – 650	2	x	x	
Hypoaspis angusta	545	5	x	x	
Hypoaspis aculeifer	550 – 685	6	x	x	
Parasitus sp.	600	1	x		
Rhodacarus sp.(large)	600	5	x	x	
Parasitus islandicus	650 – 730	2	x	x	
Macrocheles robustulus	660 – 770	1	x		
Parasitus luminarissimilis	675 - 720	1	x		

* mean length of ♀ idiosoma

Laboratory tests



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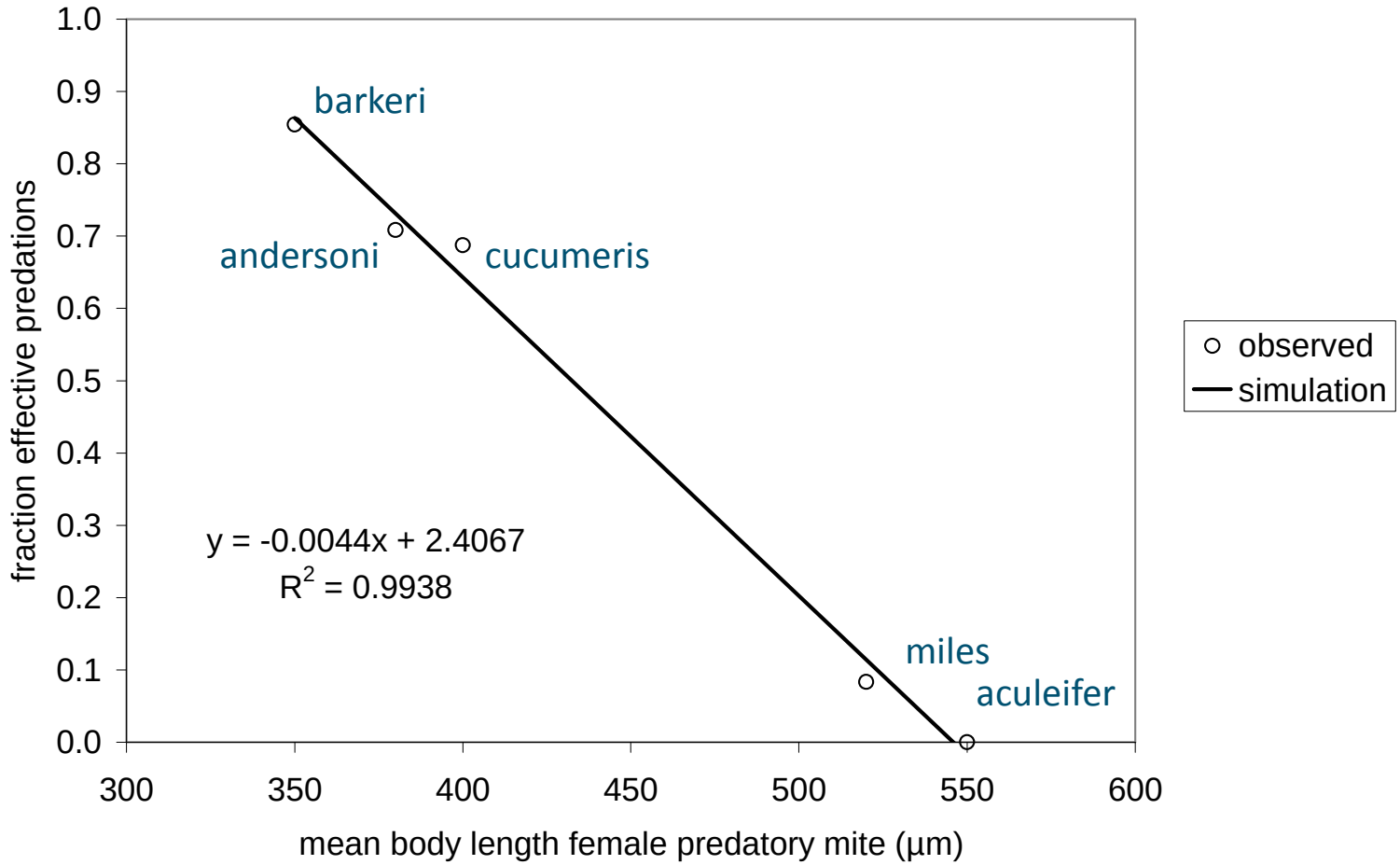
Laboratory tests



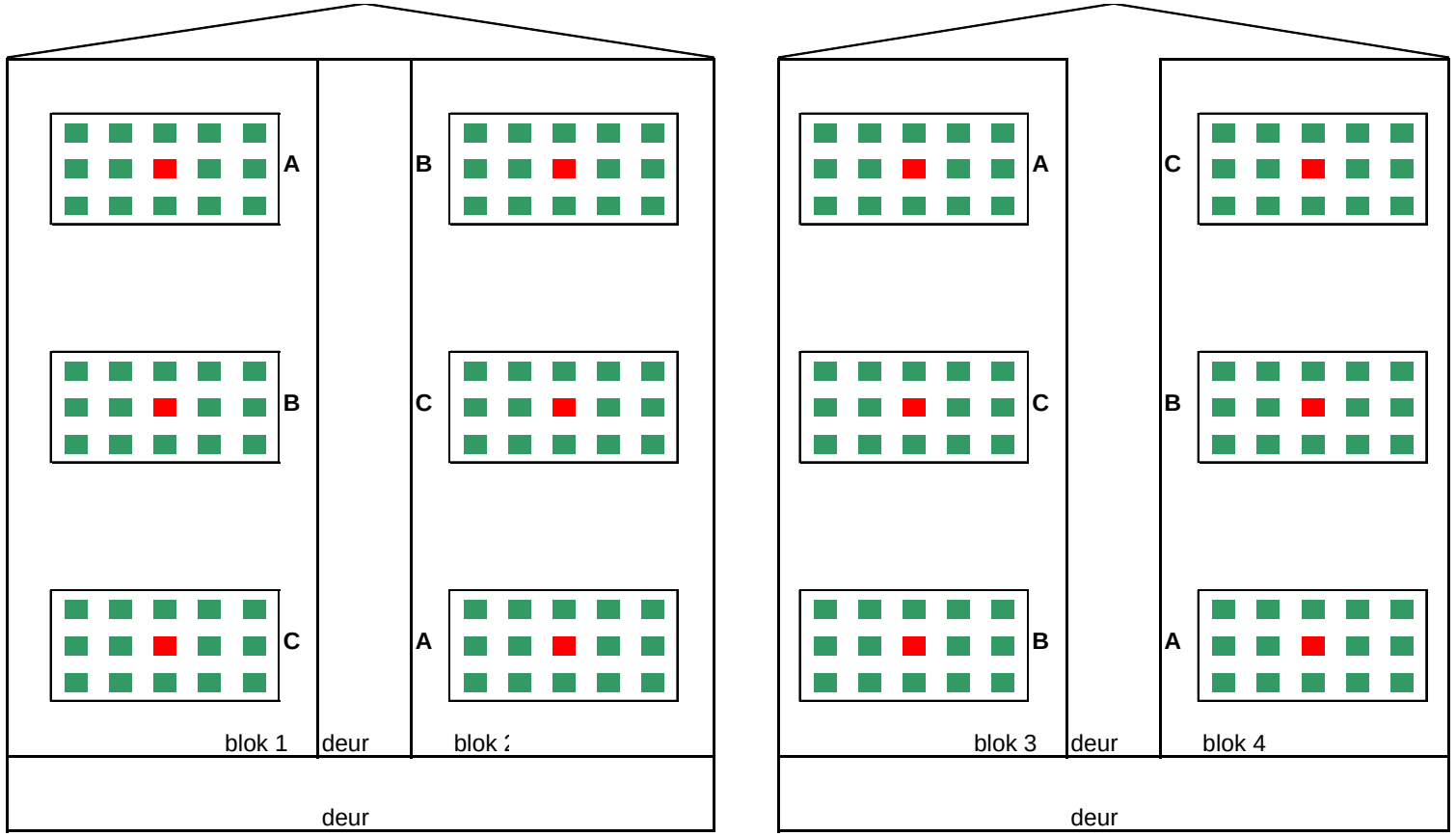

Neoseius barkeri feeding on bulb scale mite

Hypoaspis more interested in larger prey?

Further steps

- Is *Neoseiulus barkeri* able to eliminate bulb scale mites into amaryllis bulbs?
- Is *Neoseiulus barkeri* able to restrict contamination of amaryllis bulbs with the bulb scale mite from “hot spots”?
- Do mass releases on nurseries make sense?

Set up small scale greenhouse experiment



= gezonde amaryllisbol

= amaryllisbol met narcismijt

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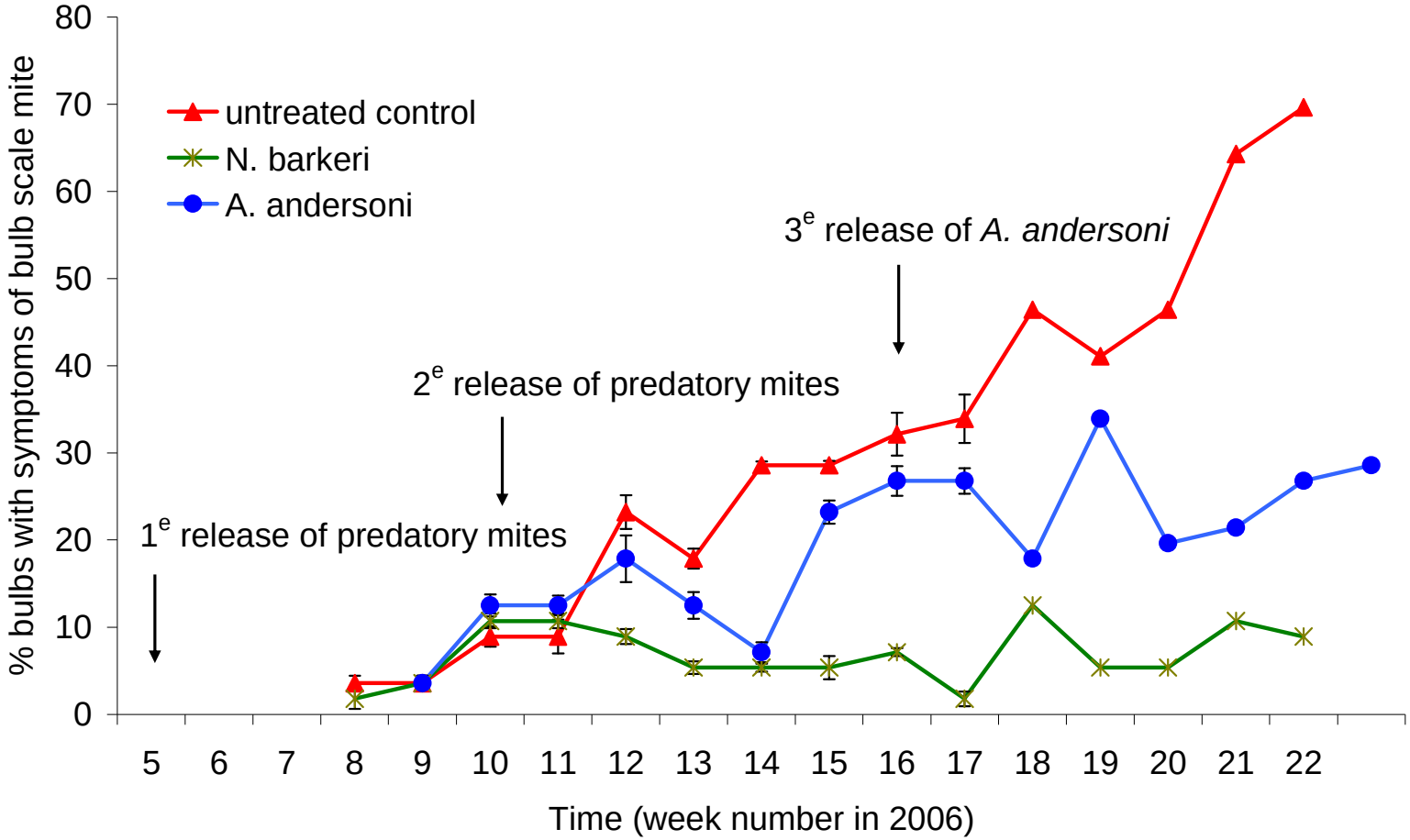
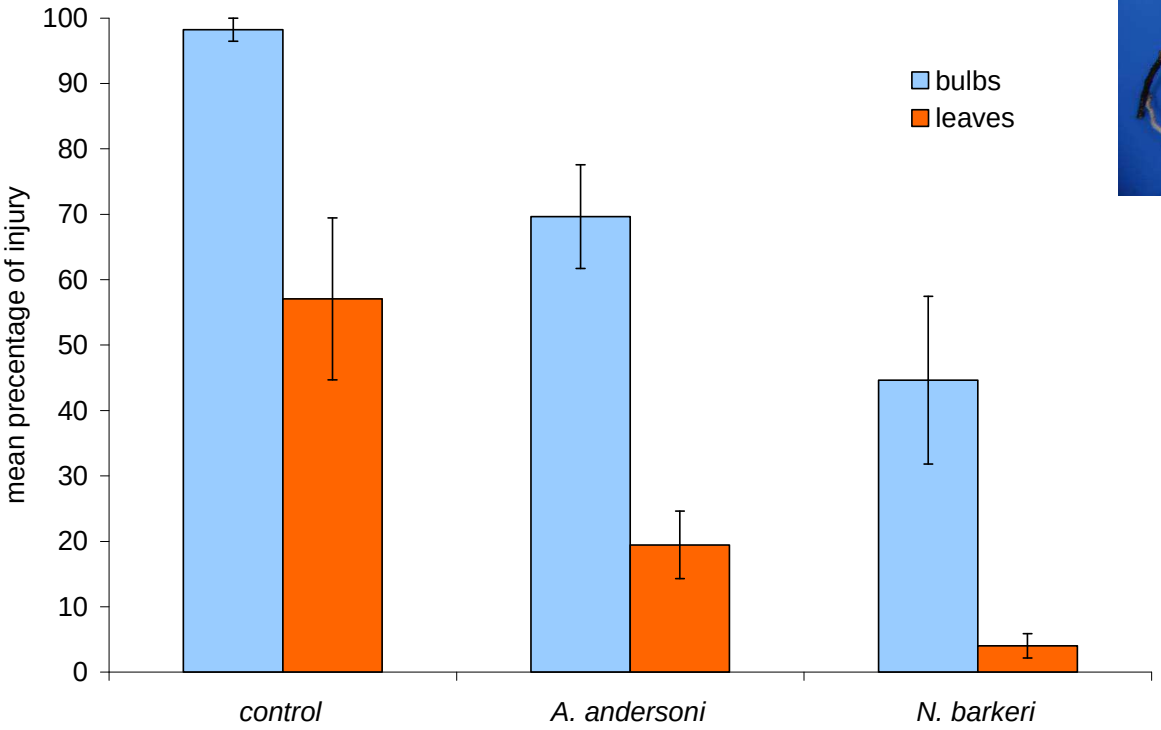
Set up small scale greenhouse experiment

Results greenhouse experiment



Results final assessment after 18 weeks



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Conclusion

Generalist predatory mites are able to slow down spread of tarsonemid mites, but combined treatments with pesticides may be required to control them

Thanks for your atention

Questions

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Uw sector investeert in dit onderzoek via het
Productschap Tuinbouw

Ministerie van Economische Zaken