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# Challenges in IPM for greenhouse crops: the importance of economic thresholds of both pest and beneficial

Rob Moerkens

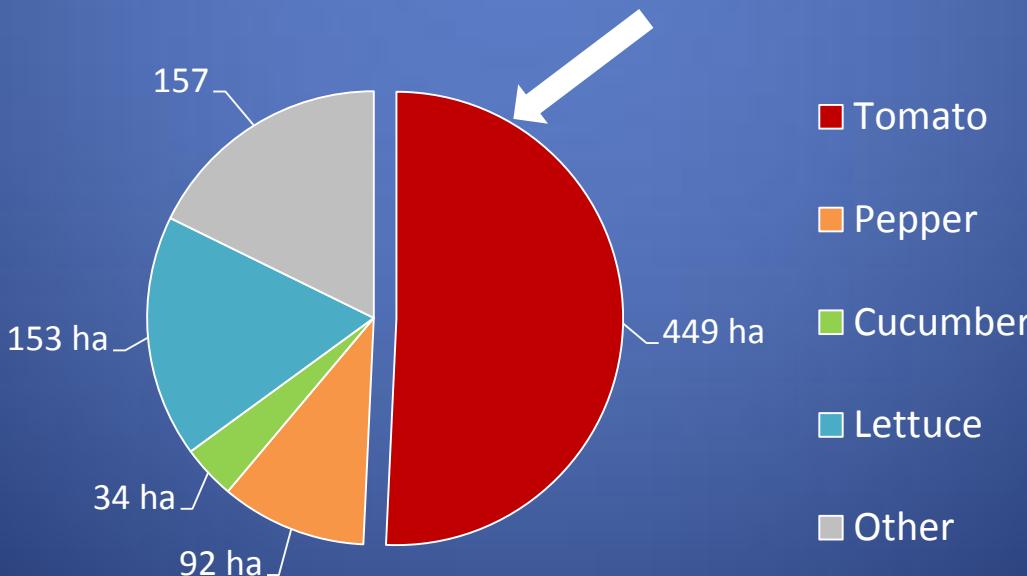
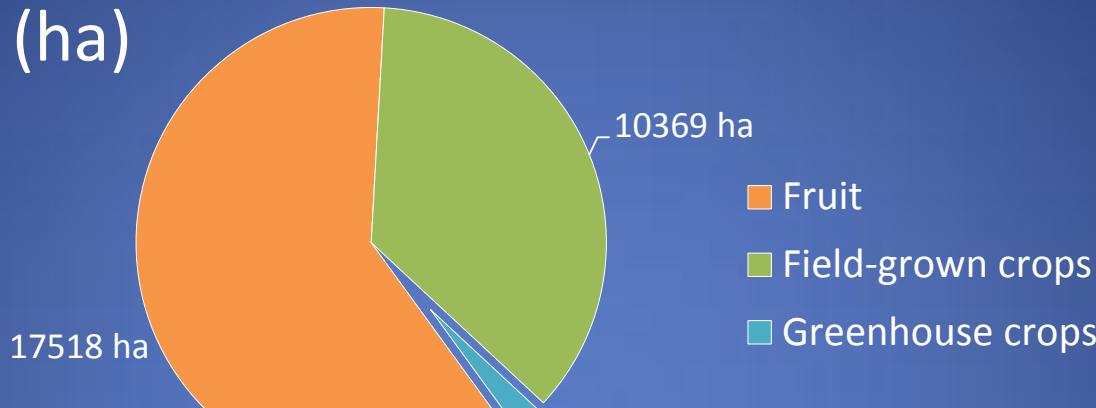
# Introduction

1. General overview
2. Biological control of whitefly
3. *Tuta absoluta*
4. Tomato russet mite



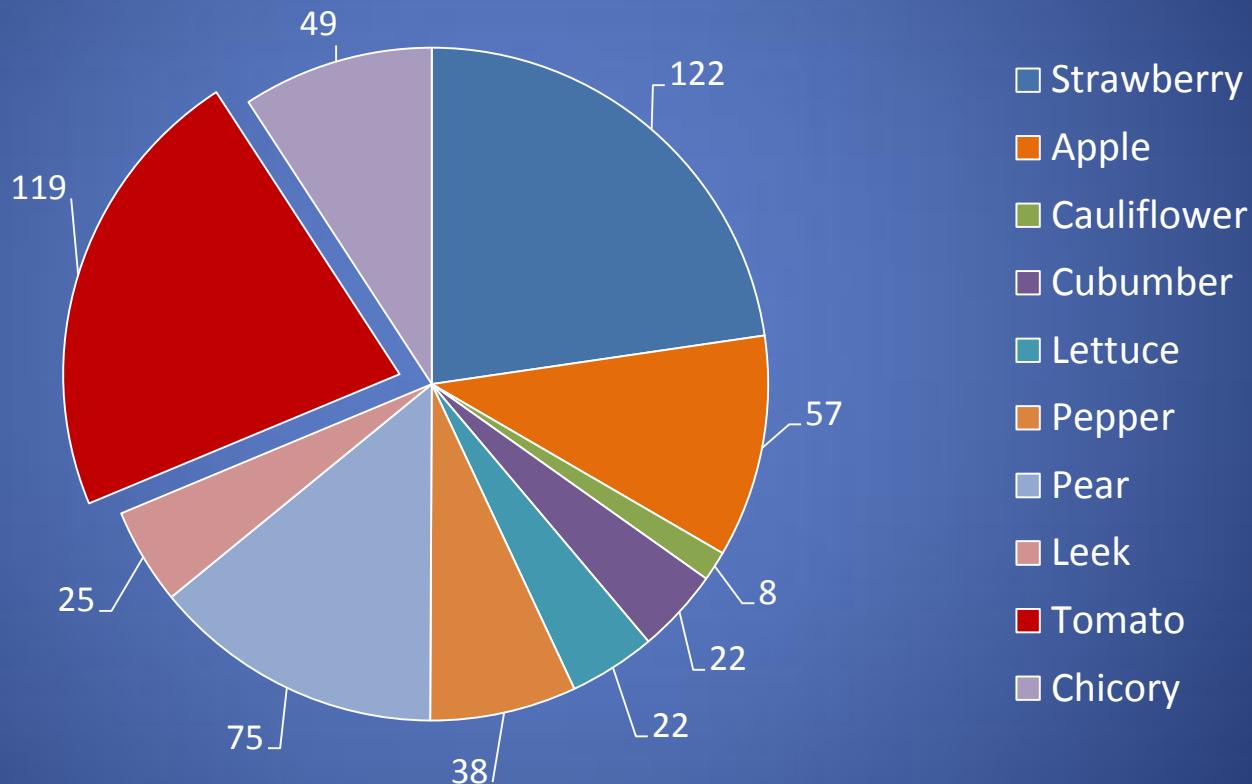
# Greenhouse crops: an overview

Area (ha)



# Greenhouse crops: an overview

Income (million euros)



# IPM in greenhouse crops

1. Prevention of pest species
2. Monitoring pest and beneficial
3. Biological control
4. Chemical control



# IPM in greenhouse crops

## 1. Prevention of pest species

- Hygiene
- Winter period: clean greenhouse
  - Start with “empty” ecosystem
- Substrate: no herbicides
- Climate conditions: e.g. fungi

## 2. Monitoring pest and beneficial

## 3. Biological control

## 4. Chemical control

# IPM in greenhouse crops

1. Prevention of pest species
2. Monitoring pest and beneficial
3. Biological control
4. Chemical control





# IPM in greenhouse crops

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1. Prevention of pest species
  2. Monitoring pest and beneficial
  3. Biological control
    - ± closed system (windows + doors)
      - < 1 year crops: no natural populations
      - Release of beneficials
    - Warm climate
      - Mediterranean pest + fast development
      - (Mediterranean) pest species can survive crop rotation during winter
  4. Chemical control

# IPM in greenhouse crops

1. Prevention of pest species
2. Monitoring pest and beneficial
3. Biological control
4. Chemical control
  - Choice of plant protection products
  - Correct use of plant protection products
  - Pest resistance





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# BIOLOGICAL CONTROL OF WHITEFLY

# Biological control of whitefly



Damage



Damage



Predation



*Macrolophus pygmaeus*  
= predatory bug

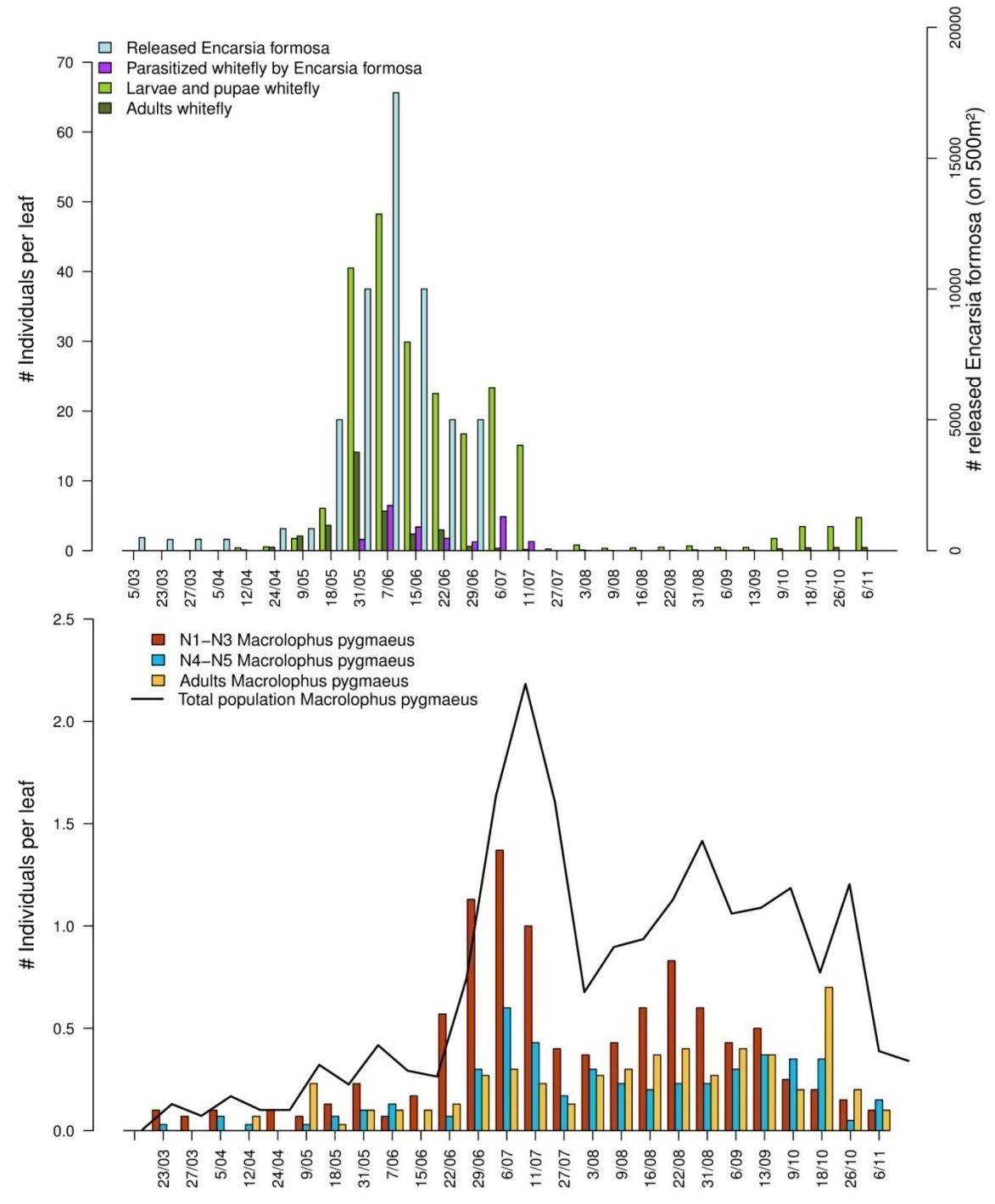
*Trialeurodes vaporariorum*  
= Whitefly

Intraguild predation

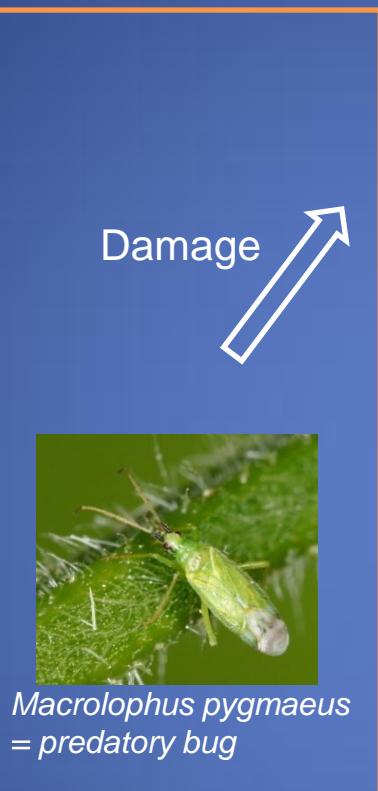


*Encarsia formosa*  
= parasitic wasp

Parasitism



# Biological control of whitefly

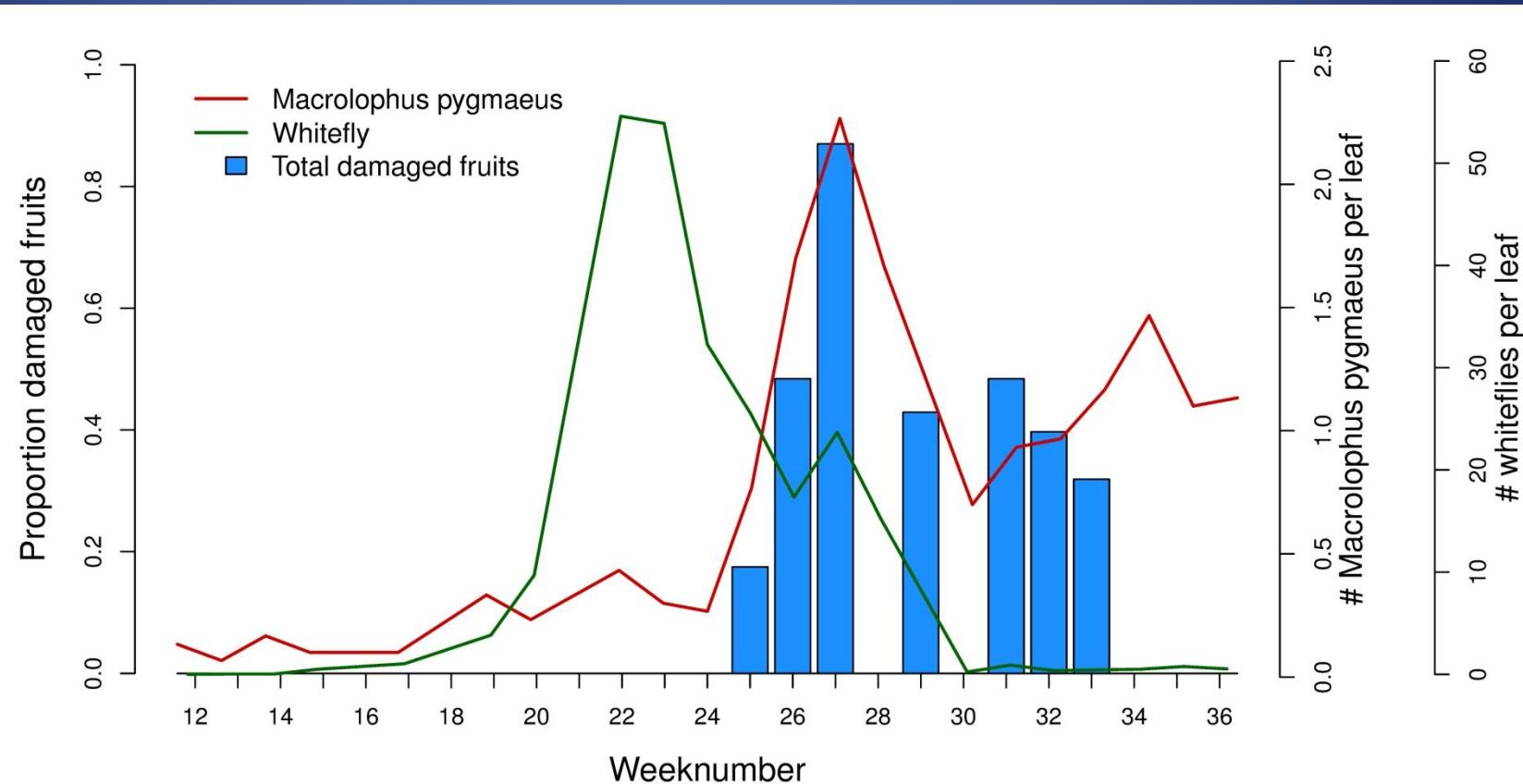


# Biological control of whitefly

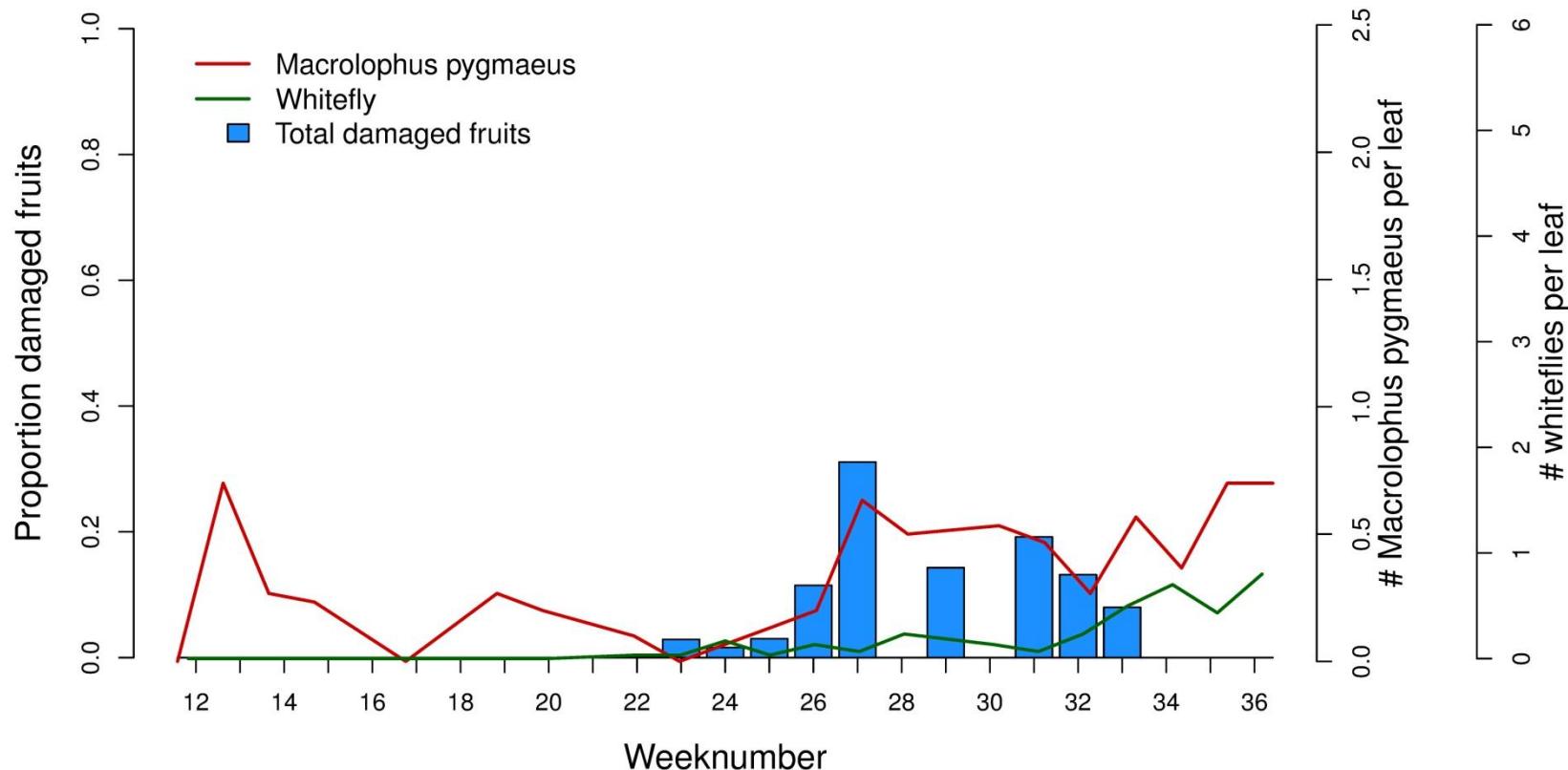
## Fruit damage



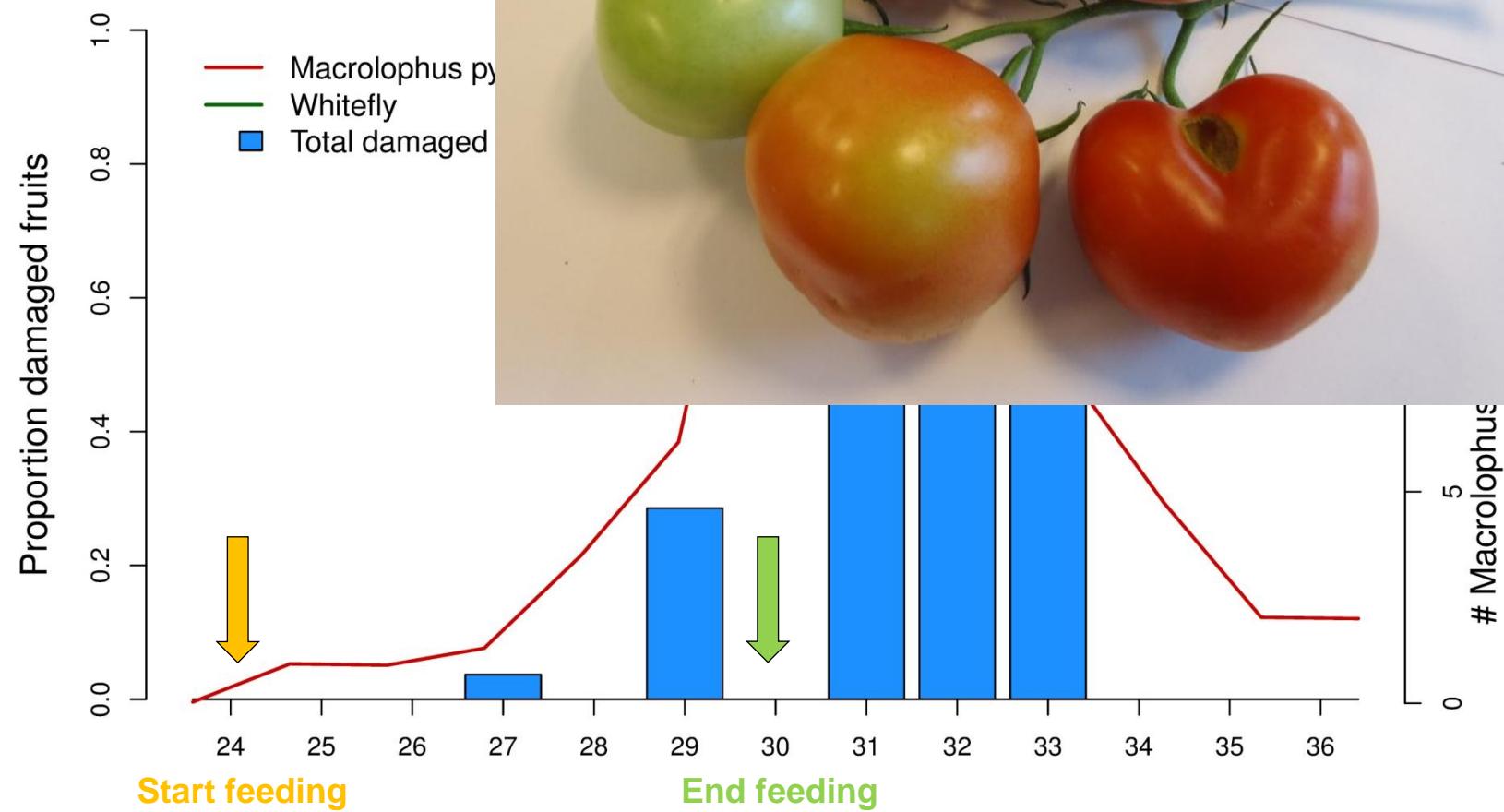
# Biological control of whitefly



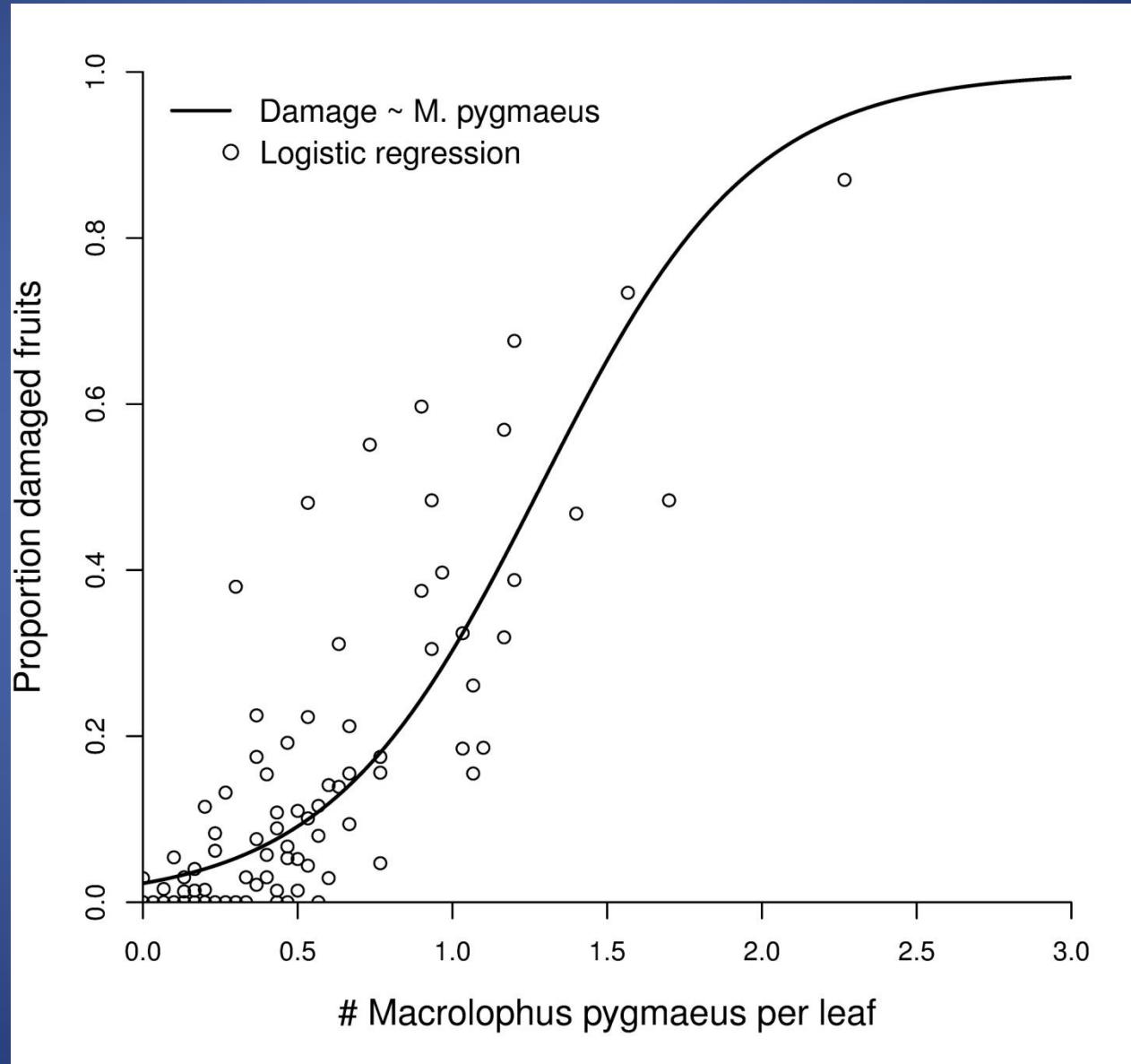
# Biological control of whitefly



# Biological control



# Biological control of whitefly



# Biological control of whitefly

## Conclusion

- Thresholds of both beneficial and pest are important!
  - Efficient monitoring is needed
  - Decision tables/ predictive models



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TUTA ABSOLUTA

# *Tuta absoluta*

## Introduction

- South American leaf miner
- 2006 in Europe
- 2009 in Belgium

=> Survives Belgian winter!



# *Tuta absoluta*

## Introduction

- Four year project



=> Develop a management strategie

# Biological control of whitefly



Damage



Damage



Predation



*Macrolophus pygmaeus*  
= predatory bug



*Trialeurodes vaporariorum*  
= Whitefly

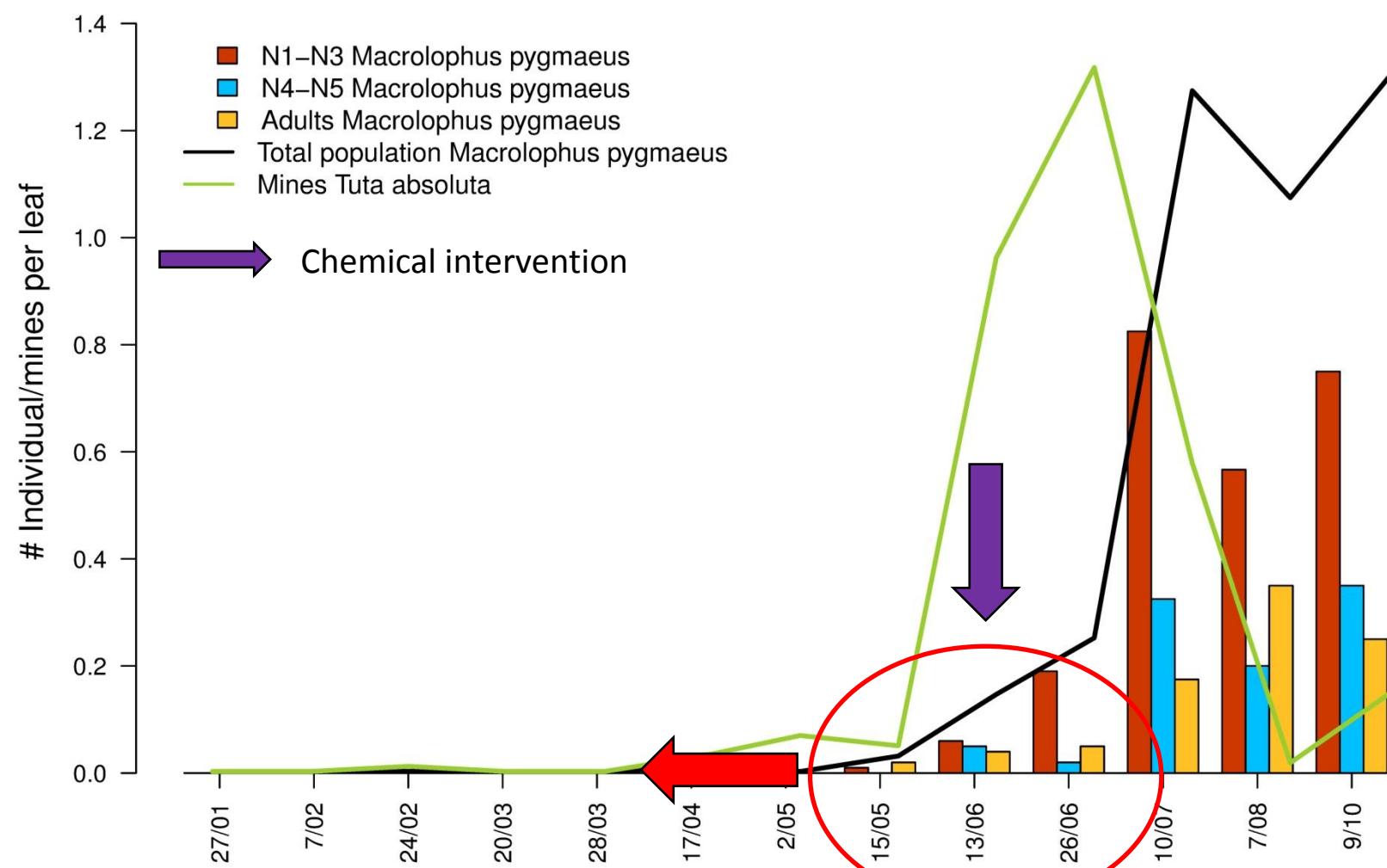
Intraguild predation



*Encarsia formosa*

Parasitism

# *Tuta absoluta*

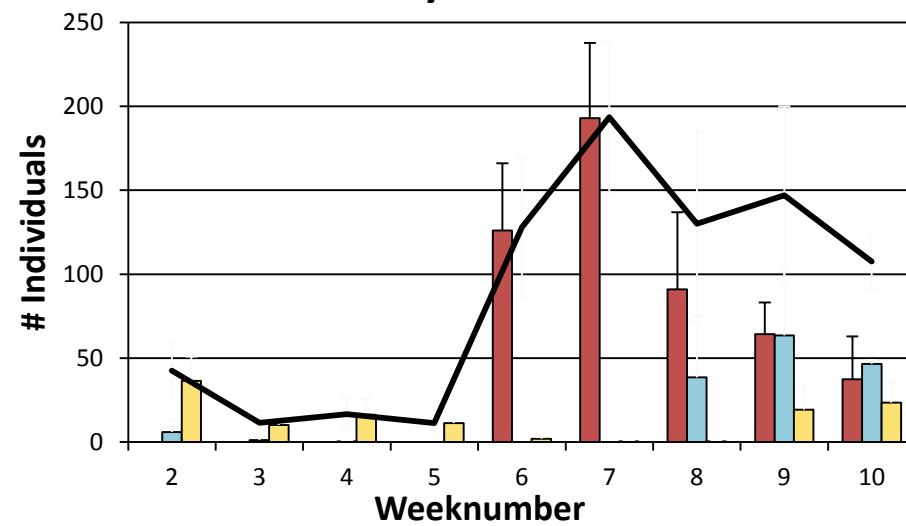


# *Tuta absoluta*

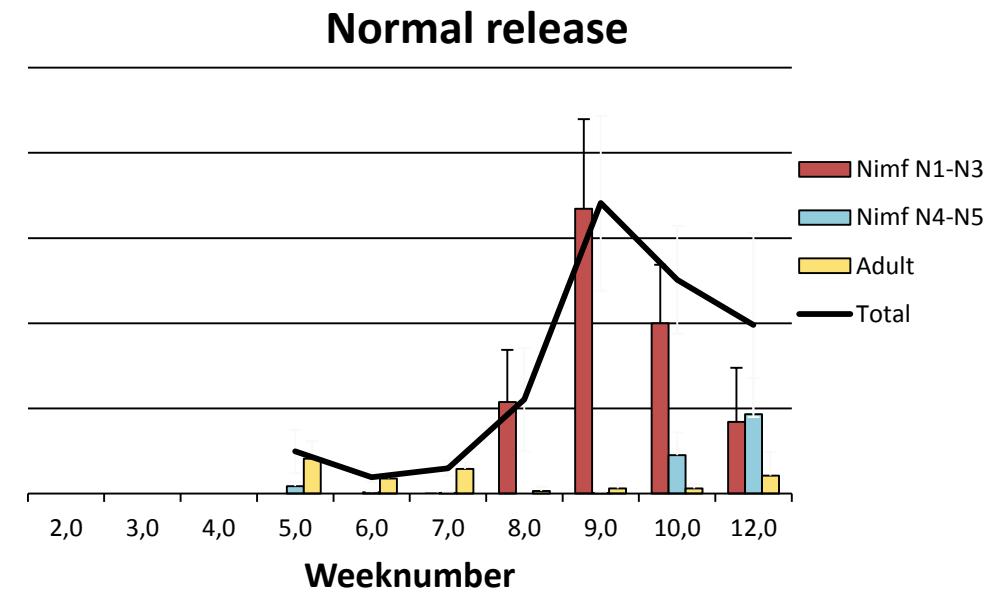
How to increase M. pygmaeus densities early in the season?

1. Early release!

Early release

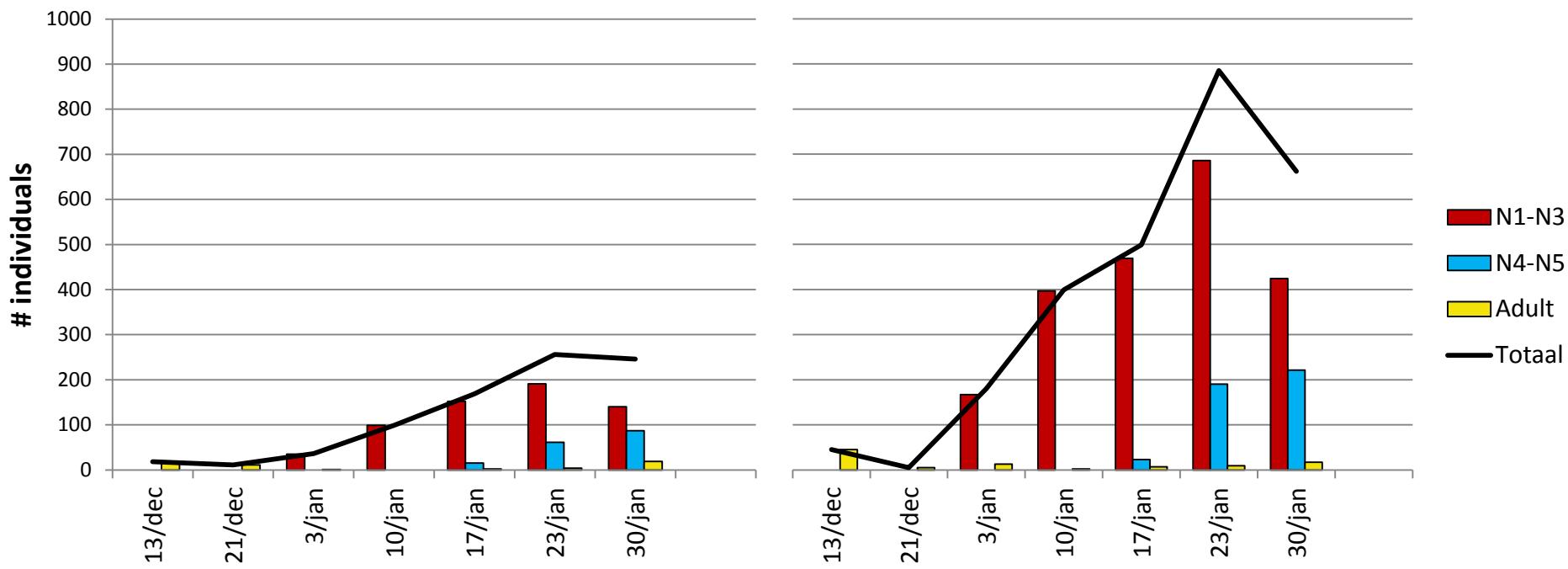


Normal release



# *Tuta absoluta*

Field trial: early release of *M. pygmaeus*



# *Tuta absoluta*

## How to increase M. pygmaeus densities early in the season?

1. Early release!
2. Additional food: Ephestia, Artemia
  - How long, distribution?
3. Release method
  - How many?
  - Distribution?
4. ...



# *Tuta absoluta*

## Other project topics

- Monitoring tomato greenhouses
  - Biological control
  - Chemical control
- Efficient monitoring system
- Predation experiments (*M. pygmaeus*)
  - Lab – semi-field – field trails
- Side-effects plant protection products on *M. pygmaeus*





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TOMATO RUSSET MITE

# Tomato russet mite

## Biology

- *Aculops lycopersici* (Tryon) (Acari: Eriophyidae)
- Mediterranean pest
- Microscopical mite
- Very fast development (25°C: generation time = 5.5 days)



# *Tomato russet mite*

## Symptoms



# *Tomato russet mite*

## Symptoms



# *Tomato russet mite*

## Biological control

- Tomato plants: glandular trichomes
  - Mites can hide and feed
  - Negative effect on biological control by predatory mites
- So far no effective biological control agent is found



# *Tomato russet mite*

## Chemical control

- Torque SC (fenbutatin-oxide)  
⇒ no longer available
- Oberon (spiromesifen)  
⇒ allowed in Netherlands, not in Belgium
- Vertimec (abamectine)  
⇒ Not selective, harmful for beneficials

⇒ Resistance risks!

# Acknowledgements

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QUESTIONS???