

Commercialization: how to get things on the market?

Willem Jan de Kogel



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Outline

- Thrips semiochemicals
- Screening criteria biocontrol

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Commercialization of thrips semiochemicals

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Frans Griepink, Rob van Tol
& David Teulon



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RANGKAPUJI APLIKASIA KAI

Thrips semiochemicals

- At 2005 Int. Thrips Conference: several presentations on semiochemicals
- Since that meeting commercial products on the market
- Overview of these products, (potential) applications, future directions

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Thrips semiochemicals

- Pheromones
 - Male aggregation pheromone of *Frankliniella occidentalis*
- Kairomones, synomones
 - Pyridine, Benzene and other compounds (plant odours)
- Allomones
 - Repellent, antifeedant plant extracts/compounds

Potential applications

- Monitoring, detection
- Synergist
 - Additive in spray
 - Activator before spray
- Control
 - Mass trapping
 - Lure and Kill/Infect
 - Repellent/deterrent/antifeedant

Three commercial products:

- Pheromone
 - Thripline AMS, Syngenta Bioline
 - Thripher, Biobest
- Kairomone
 - Lurem-TR, Koppert



Patents:

- Hamilton J.G.C. & Kirk W.D.J. (2003). Method of monitoring/controlling thrips. WO 2003/055309
- Davidson M.M., Teulon D.A.J., Perry N.D. (2005). Insect behavior modifying compounds. WO 2005/046330

Product development

- IP
 - Protection of IP
 - To publish or not (or to delay)
 - Distributer, licence agreement
- \$\$
 - Cost of active ingredients
 - Cost of product development
- Practical issues
 - Availability of active ingredients
 - Formulation of active ingredients
 - Shelf-life, storage
 - Monitoring: type of dispenser
 - Easy and simple to handle
 - How long can/must it work
- Legal
 - Local regulations (registration, import)



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www.syngenta-bioline.co.uk (2005)

Thripline ams

Thrips Monitoring System
Maximum sensitivity in thrips monitoring.
Pheromone lure enhances catches of Western Flower Thrips
Lures both male and females
Fits into a thrips ICM programme



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www.koppert.com www.PHERCBANK.com (2007)

KOPPERT BIOLOGICAL SYSTEMS

LUREM-TR.
kairomone Thripidae
LUREM-TR. increases the number of thrips caught on blue and yellow sticky traps, thus earlier discovery of the pest
LUREM-TR. is effective for several thrips species, such as *Frankliniella occidentalis* and *Thrips tabaci*
Enhances effectivity of protection measures
Can be used in all protected crops



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www.biobest.be (2007)

biobest BIOLOGICAL SYSTEMS

ThriPher: A sexual pheromone to help control western flower thrips

Quick and early detection
Chemical control by means of ThriPher lures placed on sticky traps
Chemical control by means of ThriPher lures via the CO2 dosing system
Spraying in combination with the use of the pheromone can cause an extra reduction of 30% or more!



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Monitoring


- Early detection
- Higher sensitivity



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Synergist

- Apply pheromone 2 hrs before treatment
- Up to 30% better control
- Add kairomone to spray (under investigation)



Gebruiksaanwijzing

Voor een optimale werking:

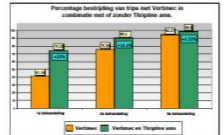
1. Plaak de capulot op de gewenstheid of bereikbaarheid met een waskingen aan de stang of draad waar de afgevoerde stof hangt.
2. Let op: voor gebruik moet de afgevoerde stof bereikbaar zijn voor de afgevoerde stof.
3. Het gebruik van Thripline moet worden gedaan op een afstand van 20-30 cm van de gewas.
4. Gebruik 1 Thripline per 100 m² voor een goede bedekking.

Let op:

- 1. Het gebruik van Thripline moet worden gedaan op een afstand van 20-30 cm van de gewas.
- 2. Het gebruik van Thripline moet worden gedaan op een afstand van 20-30 cm van de gewas.
- 3. Het gebruik van Thripline moet worden gedaan op een afstand van 20-30 cm van de gewas.

Voor een beter resultaat:

- 1. Het gebruik van Thripline moet worden gedaan op een afstand van 20-30 cm van de gewas.
- 2. Het gebruik van Thripline moet worden gedaan op een afstand van 20-30 cm van de gewas.
- 3. Het gebruik van Thripline moet worden gedaan op een afstand van 20-30 cm van de gewas.



Percentage bedekking van trips met Thripline in combinatie met of zonder Thripline alleen.

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Control

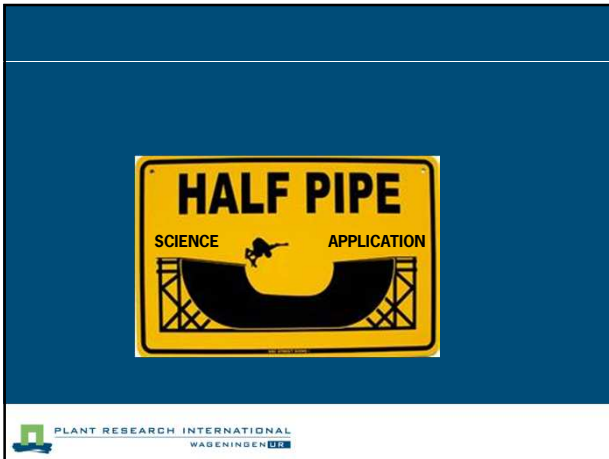
- No data available
- Mass trapping??
 - Natwick et al. 2007. Early detection and mass trapping of *F. occidentalis* and *T. tabaci* in vegetable crops.
- Lure & kill/infect??
- Push & pull??

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Questions from users after commercial launch of Lurem-TR

- How does it work
 - Does it also attract other thrips species?
 - Do I need a registration to use it?
 - From what distance are thrips attracted?
 - Do I pull thrips out of the crop?
 - Do I catch thrips entering the greenhouse?
 - Do I pull thrips into the greenhouse?
- Potential other than monitoring
 - Does it reduce the population?
 - Does it concentrate thrips in the crop close to the dispenser?
 - Can it be used as synergist or activator?
 - Can traps with Lurem-TR be used as barrier?

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Future directions

- Semiochemicals as part of thrips control strategies
- Semiochemicals for detection/monitoring quarantine thrips
- Discovery of pheromones/kairomones other thrips species
- Better understand thrips responses to odours and colours

Screening criteria for the development of commercial products for biocontrol of plant pathogens

Jürgen Köhl
 Bernard Blum
 Philippe Nicot
 Michelina Ruocco

endure
diversifying crop protection

Development of BCA's

Isolation of candidate antagonists


Efficacy testing in bio-assays

Field testing


Contacting industries

The industry's questions

- Market size ?
- Advantage above other products ?
 - Is any knowledge patented ?
 - Fungicide compatibility ?
- Production costs per hectare ?
 - Toxicological risks ?



- Does it work ?
- Shelf life ?
- Mode of action ?
- What about allergies ?
- Genetic stability ?
- ?



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The industry's questions

- Many questions for different disciplines
- Answers of plant pathologists on efficacy in bioassay and in the field not sufficient
- Input needed to answer questions very different

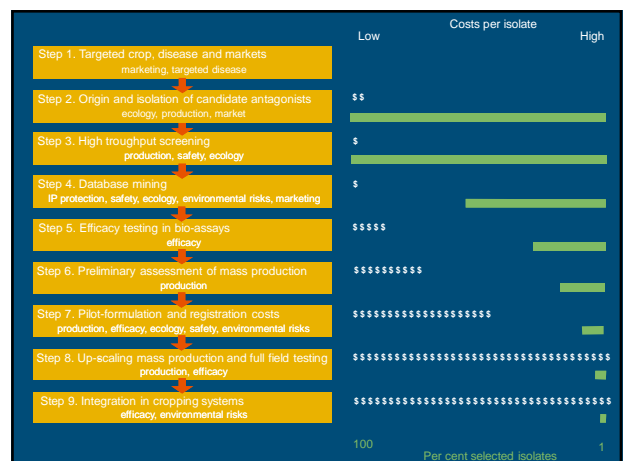
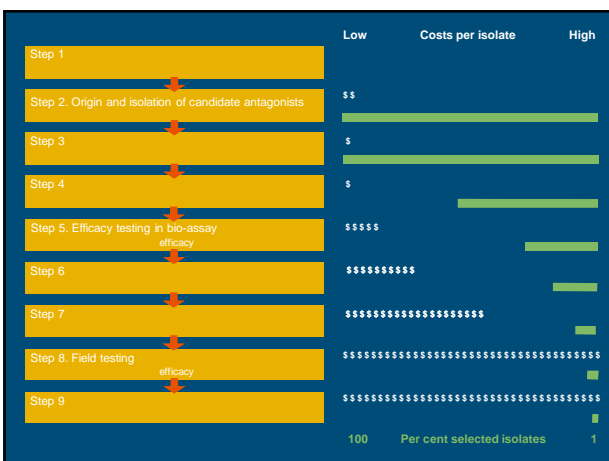


- Activity within ENDURE
- Publication of results in a journal

→ Collect questions
→ Systematic stepwise approach for screening





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Antagonist screening: Example 1

- Damping-off caused by *Rhizoctonia solani*
- Lambs lettuce sown in cold greenhouses at 0 - 5°C
- *Trichoderma harzianum* isolated in Iran
- *In vitro* screening followed by pot experiments

Step 1. Targeted crop, disease and markets
marketing, targeted disease

Step 2. Origin and isolation of candidate antagonists
ecology, production, market

Step 3. High throughput screening
production, safety, ecology

Step 4. Database mining
IP protection, safety, ecology, environmental risks, marketing

Step 5. Efficacy testing in bio-assays
efficacy

Step 6. Preliminary assessment of mass production
production

Step 7. Pilot-formulation and registration costs
production, efficacy, ecology, safety, environmental risks

Step 8. Up-scaling mass production and full field testing
production, efficacy



Step 9. Integration in cropping systems
efficacy, environmental risks

Antagonist screening: Example 2

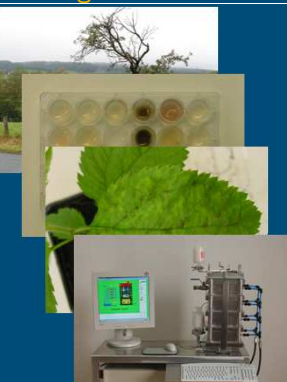
- *Venturia inaequalis* – apple scab
- Biotroph on leaves producing conidia
- Multiple cycles during summer

→ Select antagonist for scab control during summer epidemic

→ EU project REPCO: Replacement of copper fungicides





Antagonists of *Venturia* - Screening



Number of candidates	160
Pre-screening - 50%	80
Spore production	
Growth at 36 °C	
Growth at 5 °C	
Growth $a_w = 0.96$	
Efficacy testing - 84%	13
Apple seedlings	
Second screen mass production	
Fermenters - 69%	4

Antagonists of *Venturia* - Screening



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marketing, targeted disease

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production, efficacy

Step 9. Integration in cropping systems
efficacy, environmental risks

Antagonists of *Venturia* - Screening

- *Cladosporium cladosporioides* H39
- Results published
- Experiments on use in integrated apple production ongoing

Köhl, J.A. (2009). Novel micro-organisms controlling plant pathogens. International Patent Application under PCT: WO 2009/078710 A1

Köhl, J. et al. (2009). Selection and orchard testing of antagonists suppressing conidia production of the apple scab pathogen *Venturia maequalis*. Eur. J. Plant Pathol. 123:401-414

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Conclusions

Screening criteria for the development of commercial products for biocontrol of plant pathogens

- Consider many relevant questions
- Use stepwise approach
- Consider commercial questions early
- Give the cheap answers first
- Avoid expensive field testing with the wrong candidates
- Use expertise of different disciplines

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Discussion

- At what stage do you talk to industry?
- At what stage do you take other criteria than effectivity into account?
- (Un)successful examples?

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