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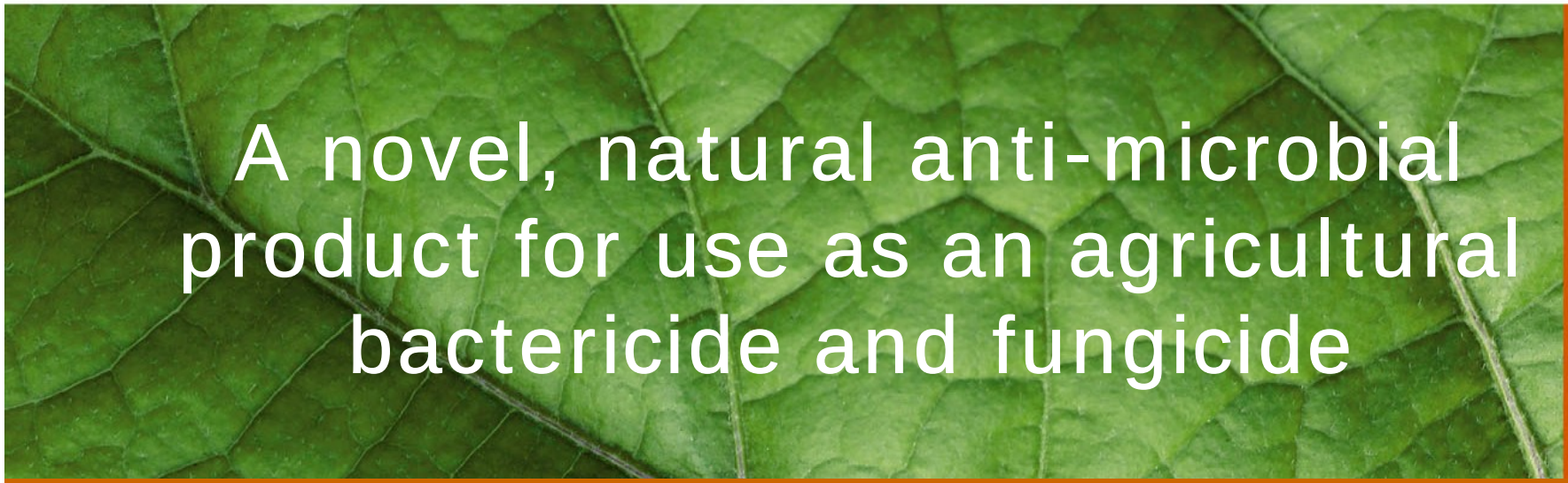
BIOLOGICAL SYSTEMS



A novel, natural anti-microbial product for use as an agricultural bactericide and fungicide

Willem Ravensberg

R&D Microbials

Koppert Biological Systems

Berkel & Rodenrijs, the Netherlands

1st Annual Biocontrol Industry Meeting,
October 23-24, 2006, Lucerne, Switzerland

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- **Introduction to the Lactoperoxidase-system**
- Koppert's LP-system
- How does LP work?
- LP as a fungicide
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- LP against viruses
- Compatibility
- Conclusions

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What is the Lactoperoxidase system?

- Occurs in animals and humans
- Important non-immune defence system
- Active system in milk, saliva, tears, etc.
- Used in food products and oral care products
- Koppert and DMV/Campina have developed it as a natural fungicide/bactericide

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DMV International
The ingredients of success

campina
natuurlijk

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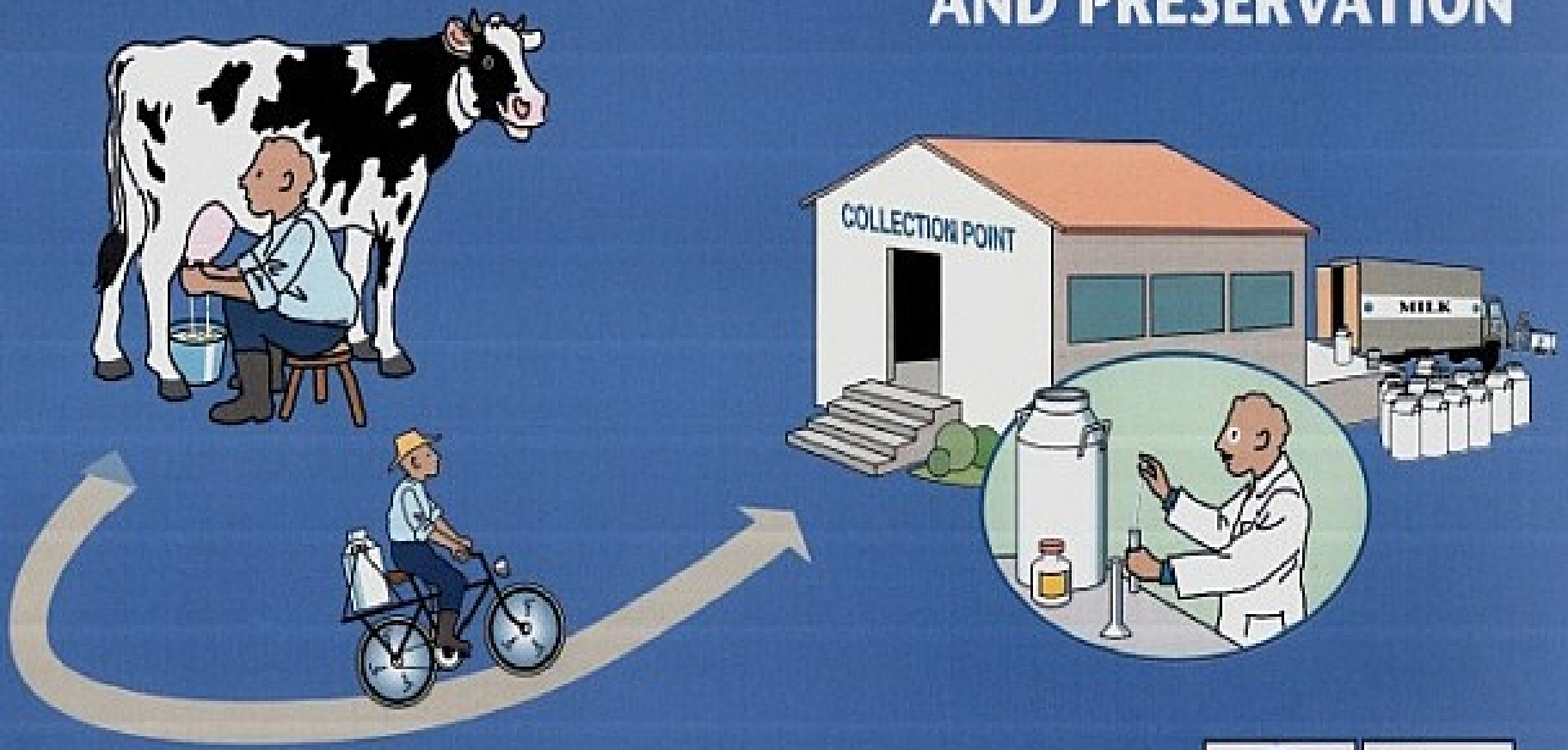
What is the LP system?

- Natural system based on:
  - 1 enzyme + 2 substrate components:
    lactoperoxidase, SCN^- and H_2O_2
- Based on the formation of reactive oxygen species that inhibit or kill bacteria
- FAO: milk preservation: addition of SCN^- and H_2O_2

SLU
WHO
GLP
IDF
FAO

Global
Lactoperoxidase
Programme

MANUAL ON THE USE OF THE LP-SYSTEM IN MILK HANDLING AND PRESERVATION



Food
and
Agriculture
Organization
of
the
United
Nations

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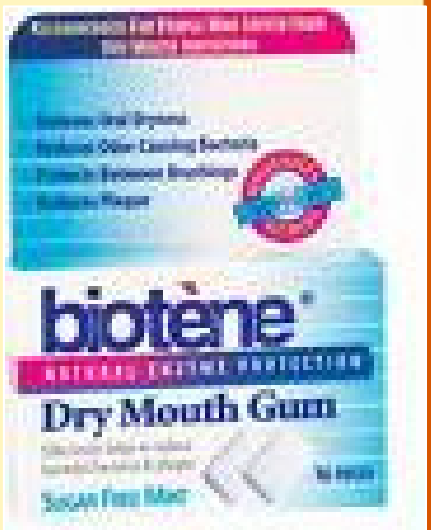
LP in oral care products

- Toothpaste (Zendium, Biotene)
- Chewing gum (Biotene, Bio-Xtra)
- Mouth rinses (Oralbalance, Biotene)



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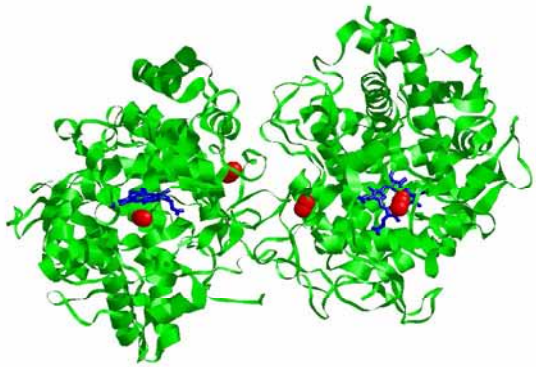
"Koppert's" LP system?

- System based on:
  - 2 enzymes + 3 substrate components
  - adjuvant based on a vegetable oil

- Based on the formation of reactive oxygen species that inactivate proteins in micro-organisms → +



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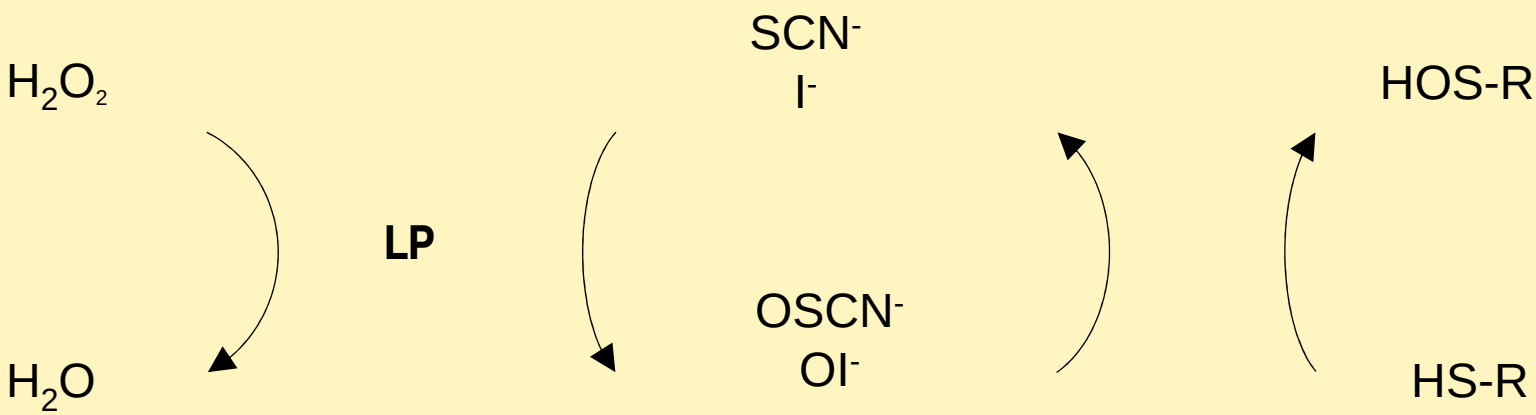
Mode of Action LP-system

LACTOPEROXIDASE SYSTEM:



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Mode of action

- Oxidation of sulfhydryl groups in proteins
- Membrane effects
- Active transports of amino acids and sugars disturbed
- Glycolytic enzymes inhibited
- Other metabolic functions disturbed

→ cell death

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Activity (1)

- Activity based on contact
- Curative action
- Activity not translaminar nor systemic
- No preventive effect
- No residual effect
- Only active in water phase – High Volume spray
- not dependent on temperature and relative humidity

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Activity (2)

- Activity on
  - fungi
  - yeast
  - bacteria
  - viruses
  - mycoplasma's
- Kills spores, cells, mycelium
- No resistance development possible due to multiple-site activity

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Research

- Target 1: powdery mildew(s)
- Protected crops worldwide
- Research model:
  - cucumber/*Sphaerotheca*
- Composition of active system
- Formulation, incl adjuvant
- Product developed

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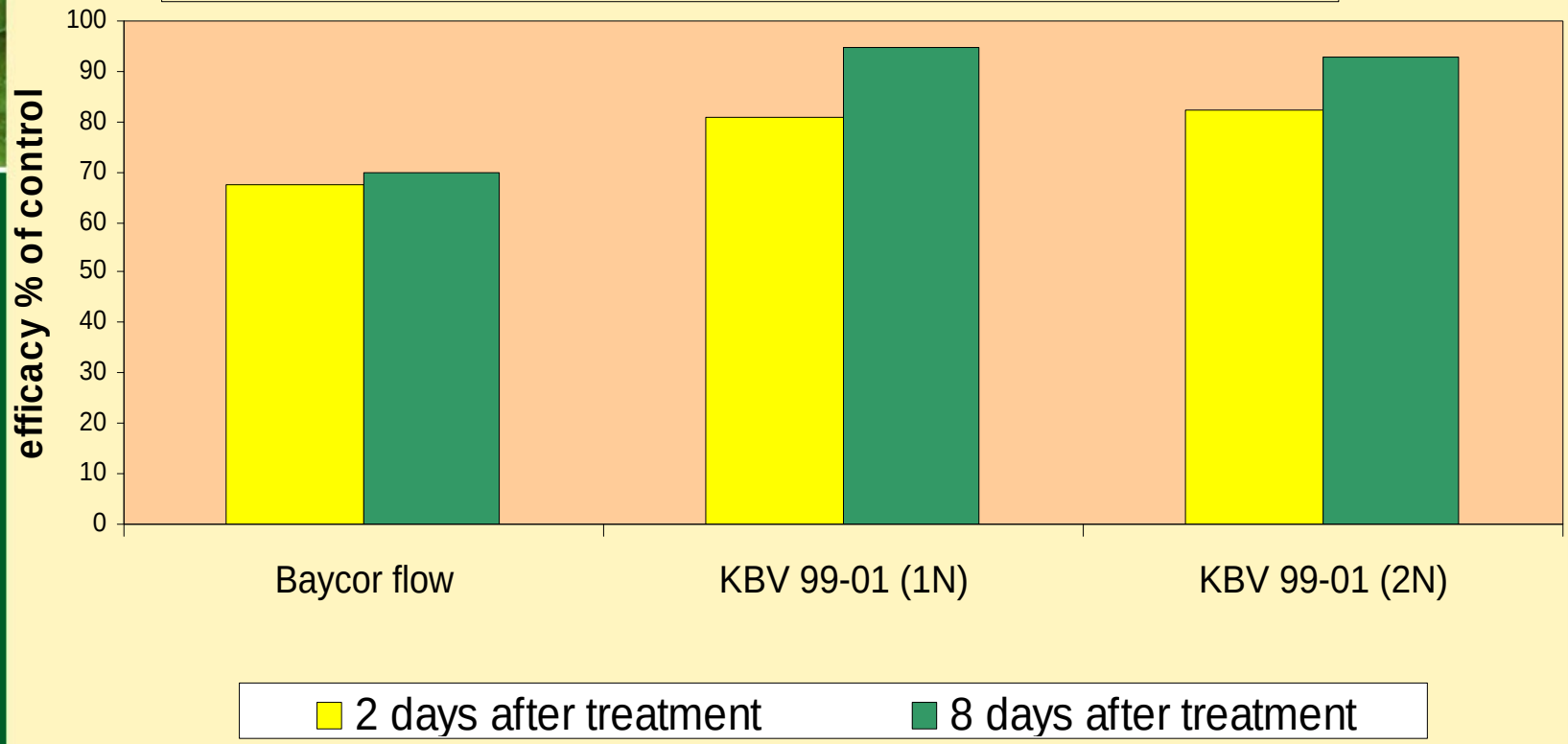
KBV 99-01 in cucumber

Control of Powdery Mildew (*Sphaerotheca fuliginea*) in cucumber (M. Post, July 2003, Nl)



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Visible effect in cucumber

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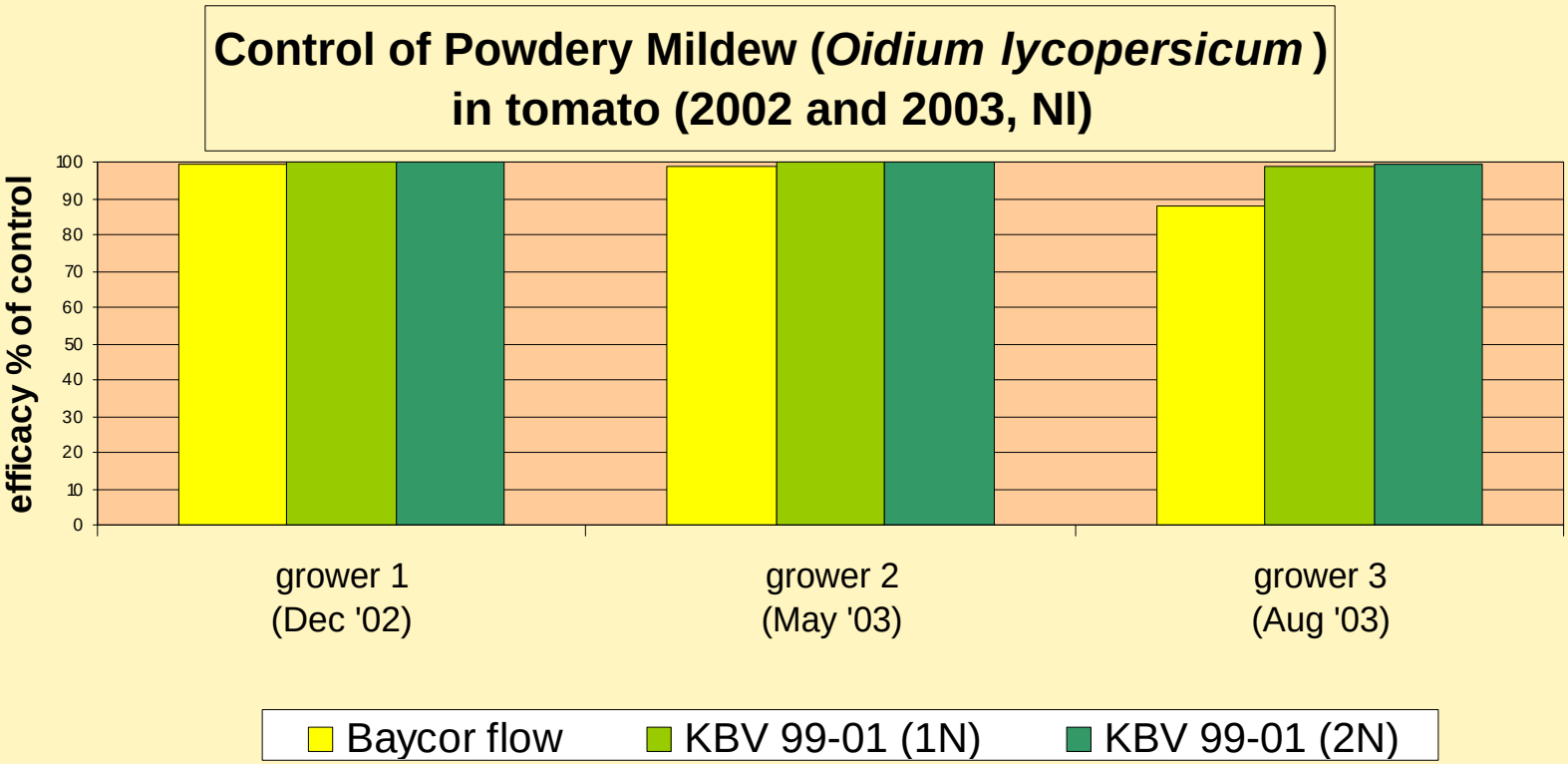
KBV 99-01 in tomato



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Visible effect in tomato

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Research

- Target 2: Fusarium oxysporum
- Bulbs
- Research model: tulip/ “zuur”
- Other bulbs and diseases in research

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Research

- Target: bacterial diseases
- Lab trials on Erwinia, Clavibacter, Pseudomonas, Xanthomonas spp. positive
- Further research needed

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Research

- Apple: fire blight
- Lab trials positive
- Field trial: result moderate
- Further research: formulation and application strategy

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LP against viruses

- Medical uses reported
- In vitro trials
  - TMV
  - PepMV

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LP against viruses

Results:

- TMV → no effect
- PepMV → variable results
  → up to 95% effect
- More research needed

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Patent

- Composition and application patented
- For use as an agricultural fungicide / bactericide

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Compatibility Enzicur with natural enemies

Natural enemy	Life stage	Direct / residue	Corrected mortality (%)	IOBC category
Amblyseius cucumeris	♀♀	Residue	15	1
Amblyseius swirskii	♀♀ Eggs	Residue Direct	17 14	1 1
Phytoseiulus persimilis	♀♀	Residue	22	1
Typhlodromus pyri	Protonymphs	Residue	22	1
	Reproduction reduction	Residue	23	1
Aphidius colemani	♀♀ Mummies	Residue Direct	9 7	1 1
Encarsia formosa	♀♀	Residue	56	3
Eretmocerus mundus	♀♀	Residue	20	1
Macrolophus caliginosus	Nymphs (L2)	Residue Direct	0 15	1 1
Orius laevigatius	Nymphs (L1)	Direct	60	3
	Nymphs (L2-3)	Residue	0	1
	Reproduction reduction	Residue	0	1
Apis mellifera	Workers	Oral Contact	0 0	1 1

Compatibility Enzicur with pesticides

Insecticides	**Commercial name**	**Fungicides**	**Commercial name**
Abamectine	Vertimec	Azoxystrobin	Ortiva
Bacillus thuringiensis	Dipel	Bitertanol	Baycor
Cyromazin	Trigard	Captan	Captan
Imidacloprid	Admire	Chloorthalovit + prochloraz	Allure
Pirimicarb	Pirimoz	Imazalit	Fungaflor
Pymetrozin	Plenem	Bicarbonate	Milstop
Pyridaben	Asepta Carex	Triflumizole	Rocket
Pyriproxifen	Admiral		
Spiromesfen	Oberon		
Teflubenzaron	Nomoet		
Thiacloprid	Calypso		
Verticillium lecanii	Mycotal	Sulphur Thiophanate-methyl	Thiovit Topsin-M

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Advantages of LP system

- A unique natural product
- No resistance
- Safe to humans, plants, animals and the environment
- Safe to natural enemies and bumblebees
- Fits in Integrated Pest Management
- Fits in organic agriculture

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Conclusions

- A new type of fungicide and bactericide
- New mode of action
- Contact activity
- Easy to use
- Potentially for a broad range of diseases and applications
- Contact: wravensberg@koppert.nl

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Thank you for your attention!

www.koppert.com

info@koppert.nl



Koppert Biological Systems

Koppert takes you further, naturally