

Tag der Insekten, Bielefeld, 30.3.2017

Schonende Kontrolle und Wie man Nutzinsekten nützlicher macht

Prof. Dr. rer. nat. Anant Patel,

Bielefeld University of Applied Sciences

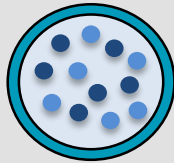
WG Fermentation and Formulation of Biologicals and Chemicals



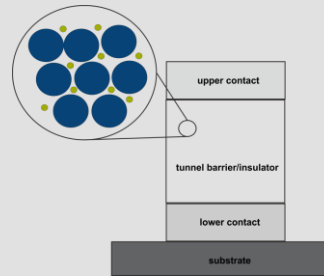
FH Bielefeld
University of
Applied Sciences

Formulation of Biologicals

- Formulation: transfer of an active ingredient into an applicable form such as capsules, layers or sprays.



capsules



layers



sprayables

- A suitable formulation improves product characteristics:
 - increased stability
 - shelf life
 - increased efficacy by slow or controlled release depending on the material properties and the physico-chemical and biochemical environment
- novel materials, methods and technology that are needed to fill the gap

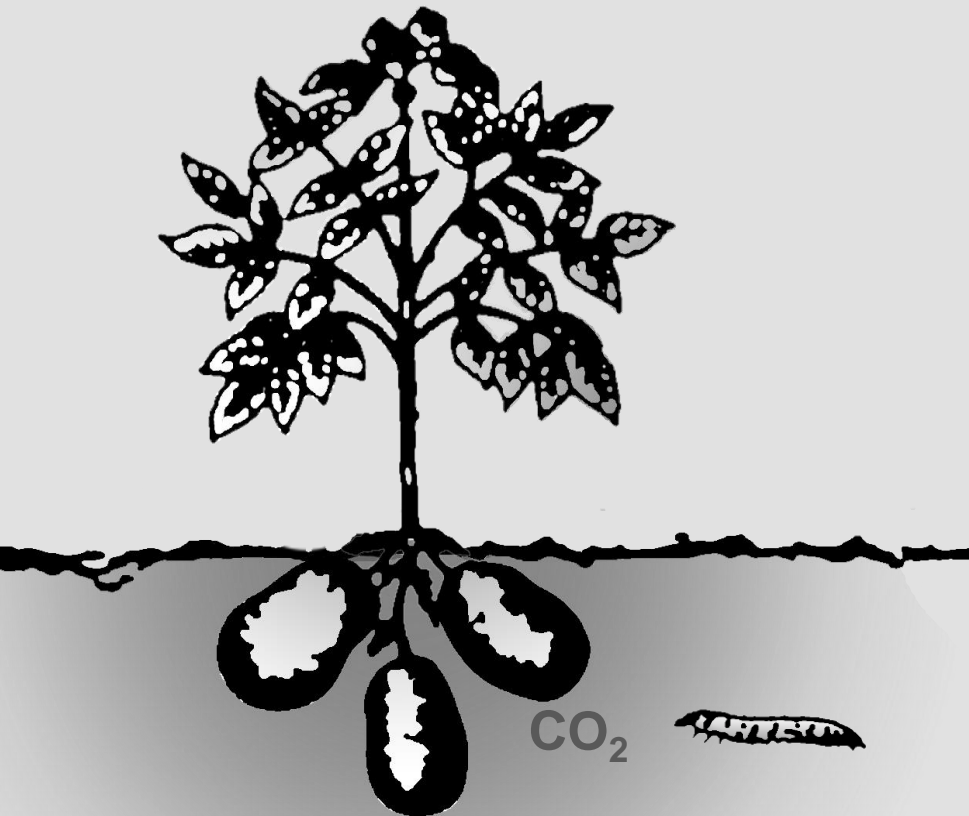
„What happens inside a formulation?“

*the relationship between formulation material **structures** and their **properties**
beneficial **interaction** of the formulation materials with the **active ingredient**
control communication with the **environment***

Attract-and-Kill

Attract-and-kill

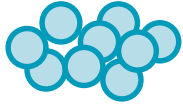
of soil-borne pest insects



Larvae use CO₂ to locate the roots of living plants
(Klingler, 1957; Doane, 1975)

- Heavy crop losses due to various soil-borne pest insects, e.g. wireworms
- Difficult control with soil insecticides
- National action plan on the sustainable use of plant protection products → **Reduce input of chemical pesticides**

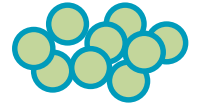
Projects



ATTRACT

Verbundprojekt

Schutz von Nutzpflanzen vor Bodenschädlingen
mittels einer innovativen „Attract-and-Kill“-Strategie

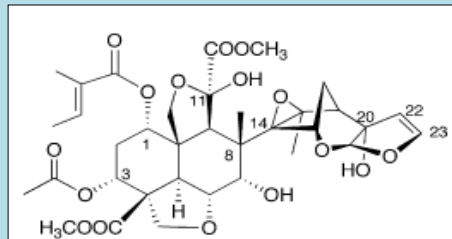


Attract = CO₂
Kill = **Neem**

NeemAza® technical:

Trifolio-M
Hochreine Biosubstanzen

- Purified active ingredients of the seed kernels of the tropical Neem tree
- Contains 33% Azadirachtin A
- Eco-friendly insecticide
 - Harmless to bees
 - No restrictions for water protection



http://openi.nlm.nih.gov/imgs/rescaled512/3153281_toxins-02-01943-g005.png

Metarhizium brunneum:

- Entomopathogenic fungi
- Soil born
- Wireworms are natural hosts
- Biocontrol agent
- Encapsulation prevents displacement of conidia in soil

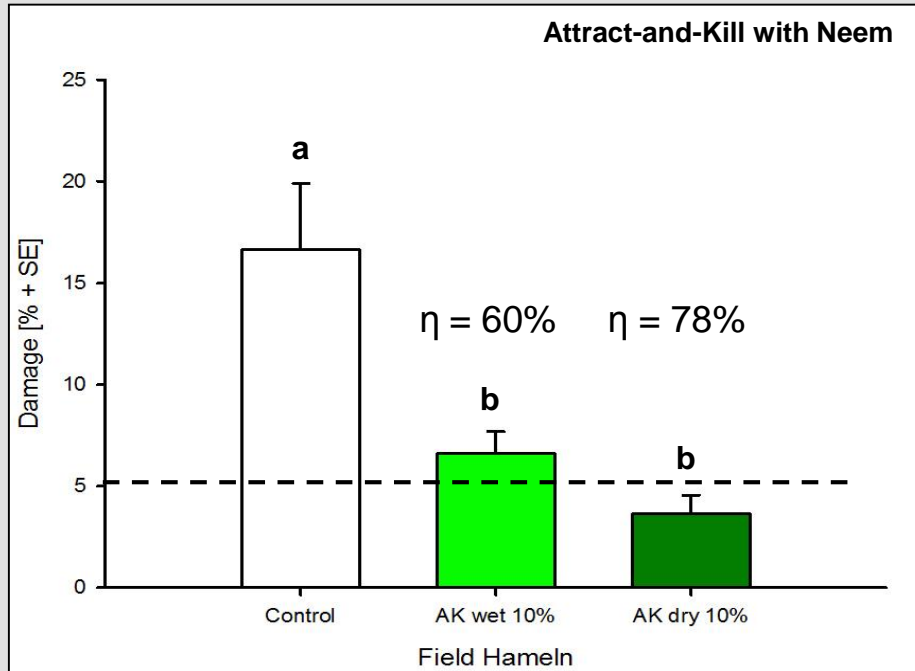


© M.Schumann

Attract = CO₂
Kill = **M. brunneum**

Attract-and-Kill

Field trials



Hameln

Cultivar: Ditta Basis



Significant reduction of wireworm damage in field trials



Attract-and-Kill

World J Microbiol Biotechnol (2017) 33:71
DOI 10.1007/s11274-017-2237-2

ORIGINAL PAPER

Co-encapsulation of amyloglucosidase with starch and *Saccharomyces cerevisiae* as basis for a long-lasting CO₂ release

Pascal Humbert¹ · Marina Vemmer¹ · Marco Giampà² · Hanna Bednarz² · Karsten Niehaus² · Anant V. Patel¹

J Pest Sci
DOI 10.1007/s10340-016-0824-x



ORIGINAL PAPER

Wireworm damage reduction in potatoes with an attract-and-kill strategy using *Metarhizium brunneum*

M. A. Brandl¹ · M. Schumann¹ · M. Przyklenk² · A. Patel² · S. Vidal¹



Innovationspreis 2016 des Landkreises Göttingen

Bernard Blum Award for Novel Biocontrol Solutions



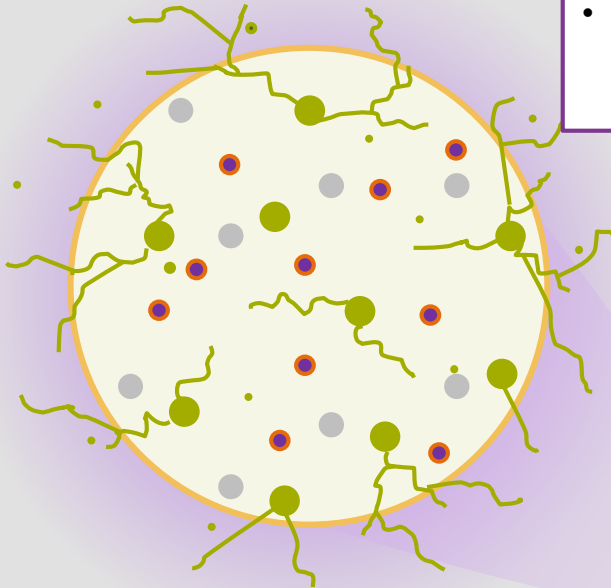
WG Anant Patel: „Fermentation and formulation of biologicals and chemicals“
COST FA1405 Workshop 29-30. September 2016

Attract-and-Kill – BIOZEC

biological tick control agent

ATTRACT: CO₂ and Semiochemicals

- Baker's yeast for CO₂ production
- Specific CO₂ receptors in ticks
- Successful preliminary tests on the attraction of *Ixodes ricinus*
- Novel bioassay was developed for attraction and aggregation of ticks



Mit Zecken zum Doppelsieg



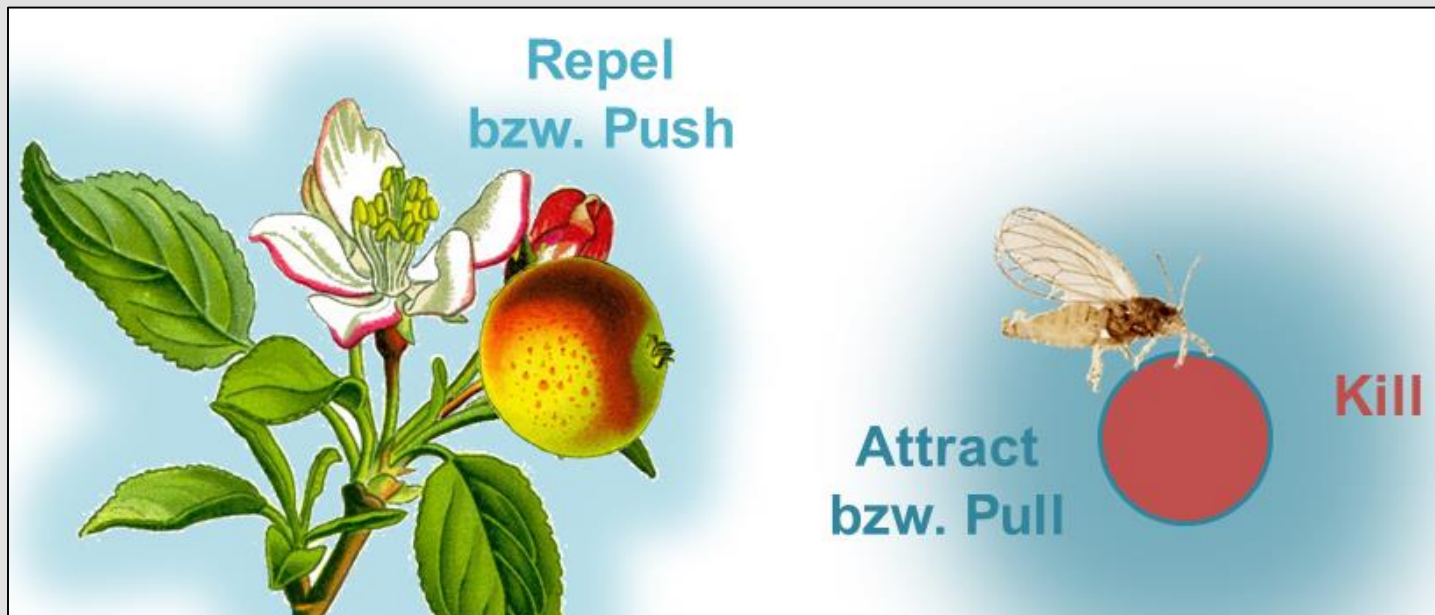
Sissy Lorenz, die an der Bielefelder FH studiert, und der Kölner Samuel Kroll haben sich für das Deutschland-Finale des Wissenschaftswettbewerbs Fame-Lab qualifiziert. Sie freuen sich über die Plätze eins und zwei des Vorentscheides im Theaterhaus. Foto: Bielefeld Marketing

KILL: *Metarhizium flavoviride*

- Entomopathogenic fungi
- Isolated from a German *Ixodes ricinus* adult
- Ticks are natural hosts
- Biocontrol agent
- Proven to be virulent to *I. ricinus*

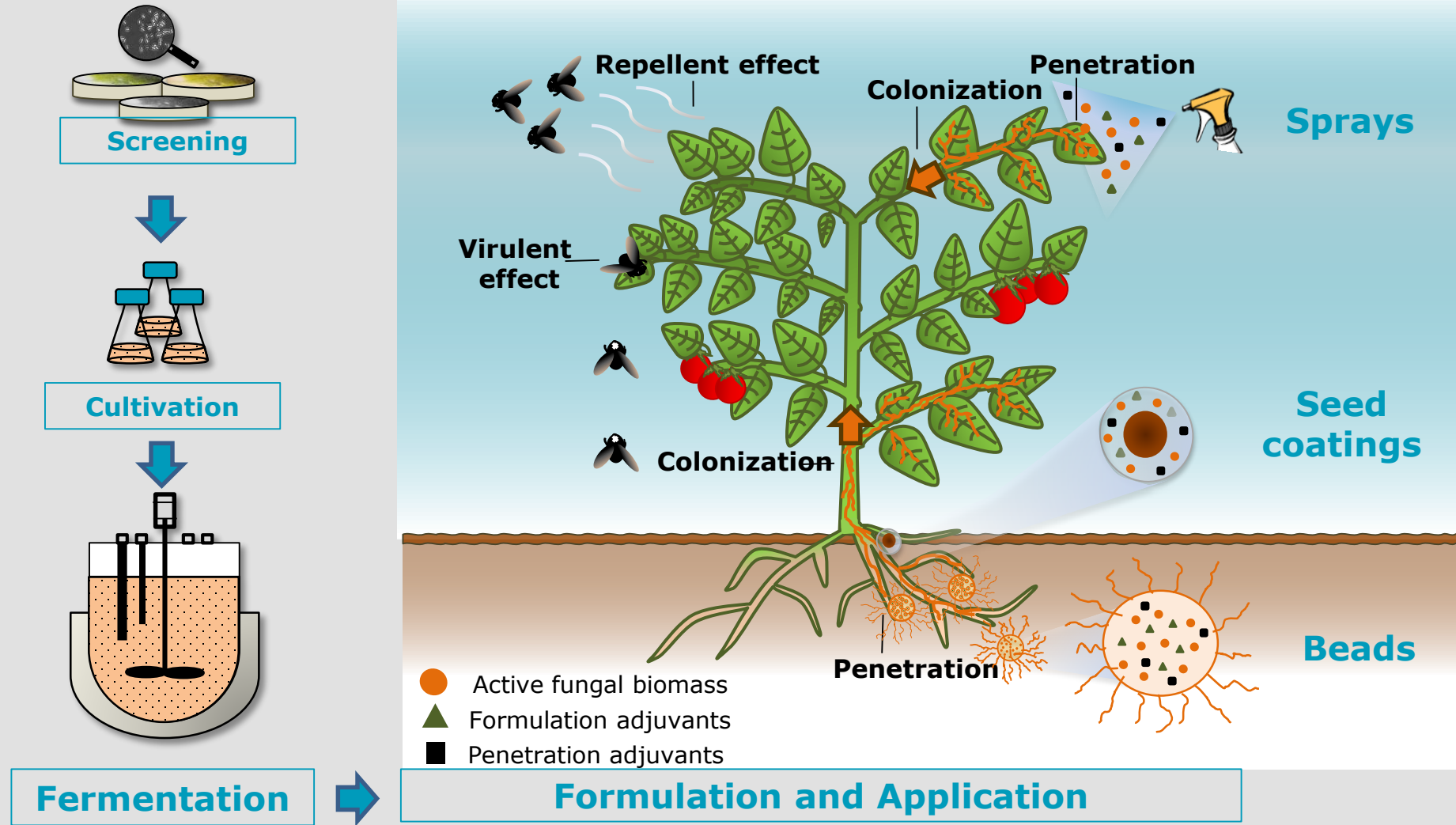
PICTA-KILL

- *Cacopsylla picta*: Vector of *Candidatus* Phytoplasma mali, the infectious agent of apple proliferation
- Annual economic loss of a three-digit-million range in Europe
- No direct measures to combat apple proliferation
- Control of the vector



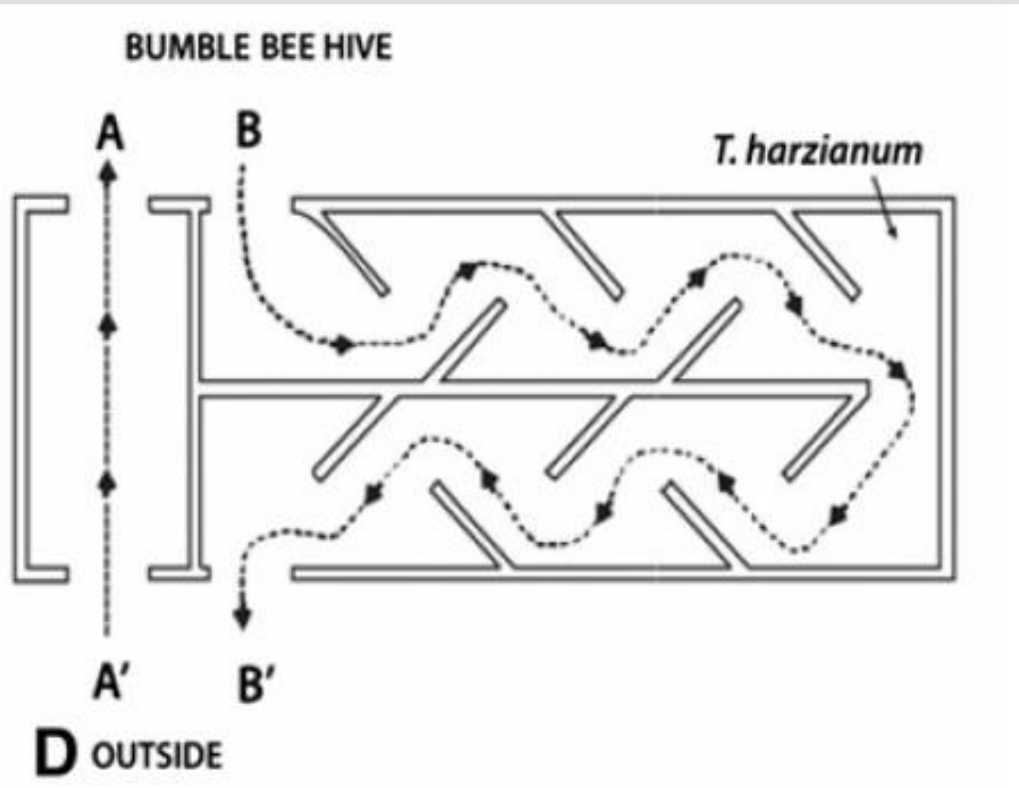
Biocontrol with endophytes

Systemic protection from herbivorous insect pests



Entomovectoring

Delivery of microorganisms via arthropods



Two-way dispensers for bumble bees
(Houle)



Flying Doctors Hive (bumble bee)

Entomovectoring

Delivery of microorganisms via arthropods

Formulations: stability of BCA and vector compatibility



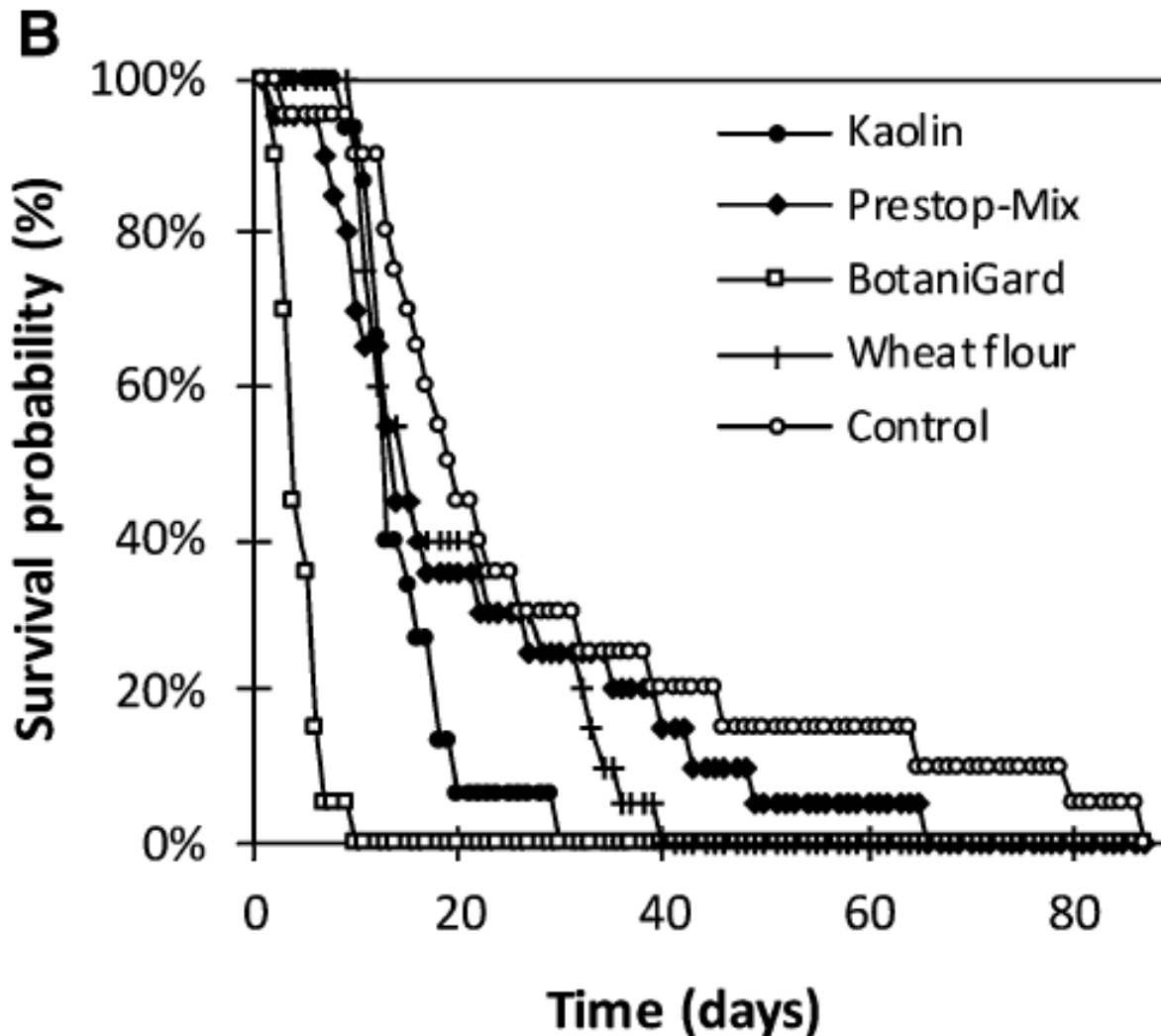
Peng et al. (1992)

What about microorganisms in the insect?

Smagghe, G., Mommaerts, V., Hokkanen, H., Menzler-Hokkanen, I. (2015) Multitrophic Interactions: The Entomovector Technology

IN: Arthropod-plant interactions – novel insights and approaches for IPM. Springer. Smagghe, G. & Diaz, I. (eds.)

Delivery of microorganisms via arthropods



Karise et al., 2015,
J. Pest. Sci.

Artificial insect diets

aphid



mass production of the
beneficial insect
Chrysoperla (green
lacewing)

medium



Working group Patel

Prof. Dr. rer. nat. Anant Patel

Dr. rer. nat. Desiree Jakobs-Schönwandt

Dr. rer. nat. Marina Vemmer

B. Sc. Karin Heinritz

Ph D students

M.Sc. Michael Przyklenk

M.Sc. Pascal Humbert

M.Sc. Sarah Vanessa Homburg

M.Sc. Peter Spieth

M.Sc. Vivien Krell

M.Sc. Annika Lemke

M.Sc. Sissy Lorenz

M.Sc. Jan Pauly

M.Sc. Mauricio Cruz

M.Sc. Jnanada Joshi

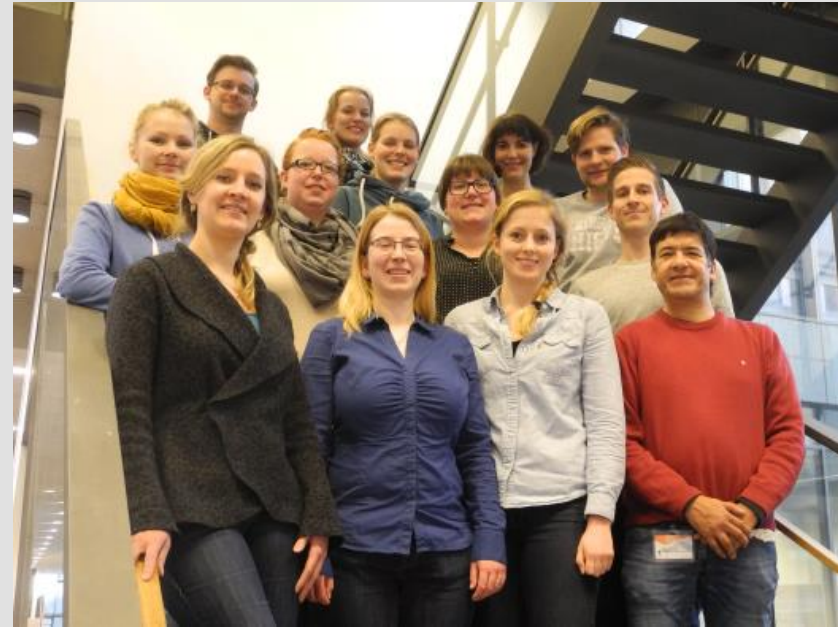
M.Sc. Linda Muskat

M.Sc. Katharina Herrmann

N.N.

N.N.

+ 25 students



Funds from BMBF, BMELV, EU, DBU, VW, AiF, North-Rhine Westphalia, industry, university,...

International collaborations:

Universities: Cordoba, Copenhagen, Innsbruck, Swansea, Institut Agroscope-Reckenholz, IITA Cameroon/Kenya, USDA/ARS Georgia and Montana, Agriculture and Agri-Food Canada, National Chemical Laboratories Pune, Central Salt & Marine Chemicals Research Institute Bhavnagar, ...