



Breeding Invertebrates for Next Generation Biocontrol

Bart Pannebakker – Coordinator
Laboratory of Genetics – Wageningen University
bart.pannebakker@wur.nl

Food security

- Food security under threat by current & invasive pests
- Invertebrate pests destroy **20% of world food production** (€73 billion)
- Protection challenging
 - EU pesticide regulations



Biological control

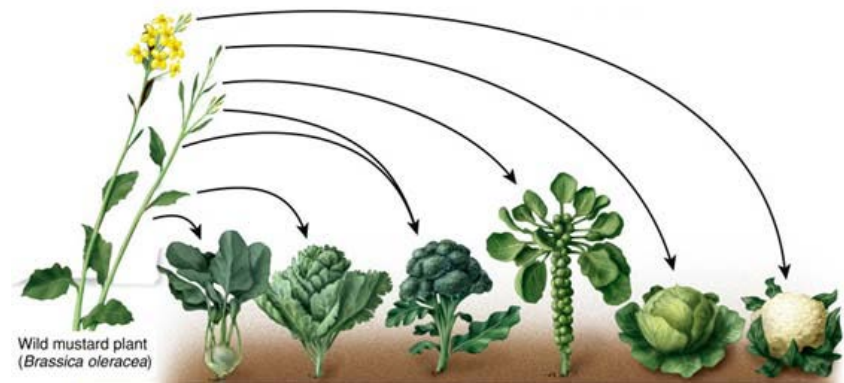


- Biological control: safe solution
- Often relies on imported natural enemies
- Regulations restrict import of exotic biocontrol agents
 - Biosafety concerns
 - Nagoya protocol
 - Access & Benefits Sharing



Optimization

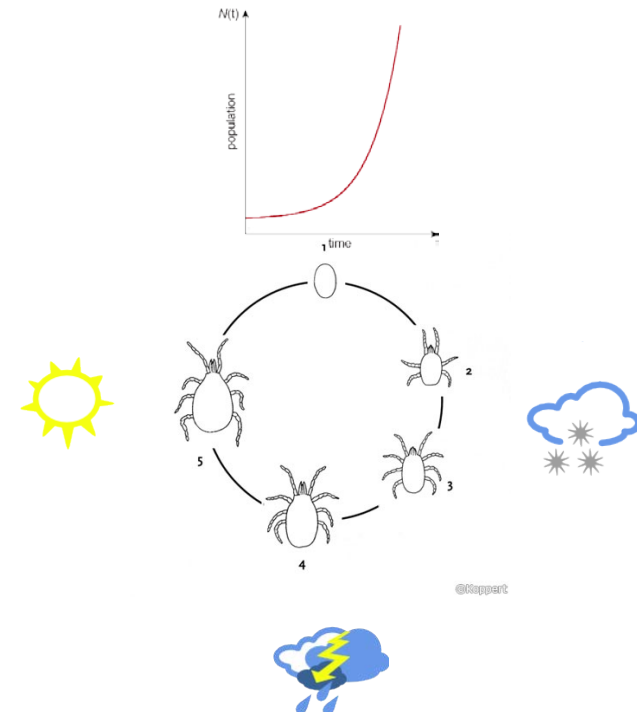
- Optimize existing and native biocontrol agents
 - Reduce dependence on imported natural enemies
- Exploit existing **natural genetic variation** to improve efficiency
 - Selection of strains from nature
 - Selective breeding



Traits to target



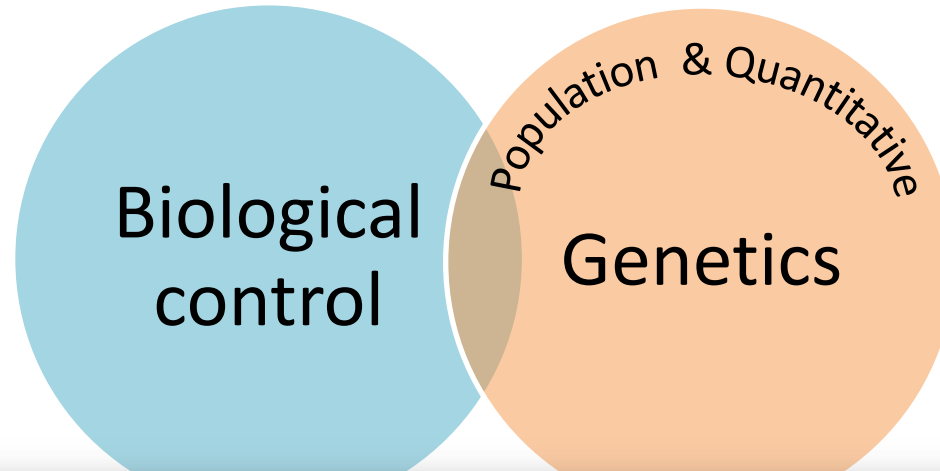
- System specific
 - Crop, pest, natural enemy
- Life-history traits
 - Reproductive potential
 - Environmental sensitivity
- Modelling studies



BINGO-ITN

- Innovative Training Network for Early Stage Researchers
- Advance current knowledge on the use of natural genetic variation in biocontrol practice
- Enhance the application of (quantitative) genetic methods to invertebrate biocontrol
- Train young researchers in an extensive suite of interdisciplinary skills

Genetic improvement



**Entomologia
Experimentalis et Applicata**

February 2017



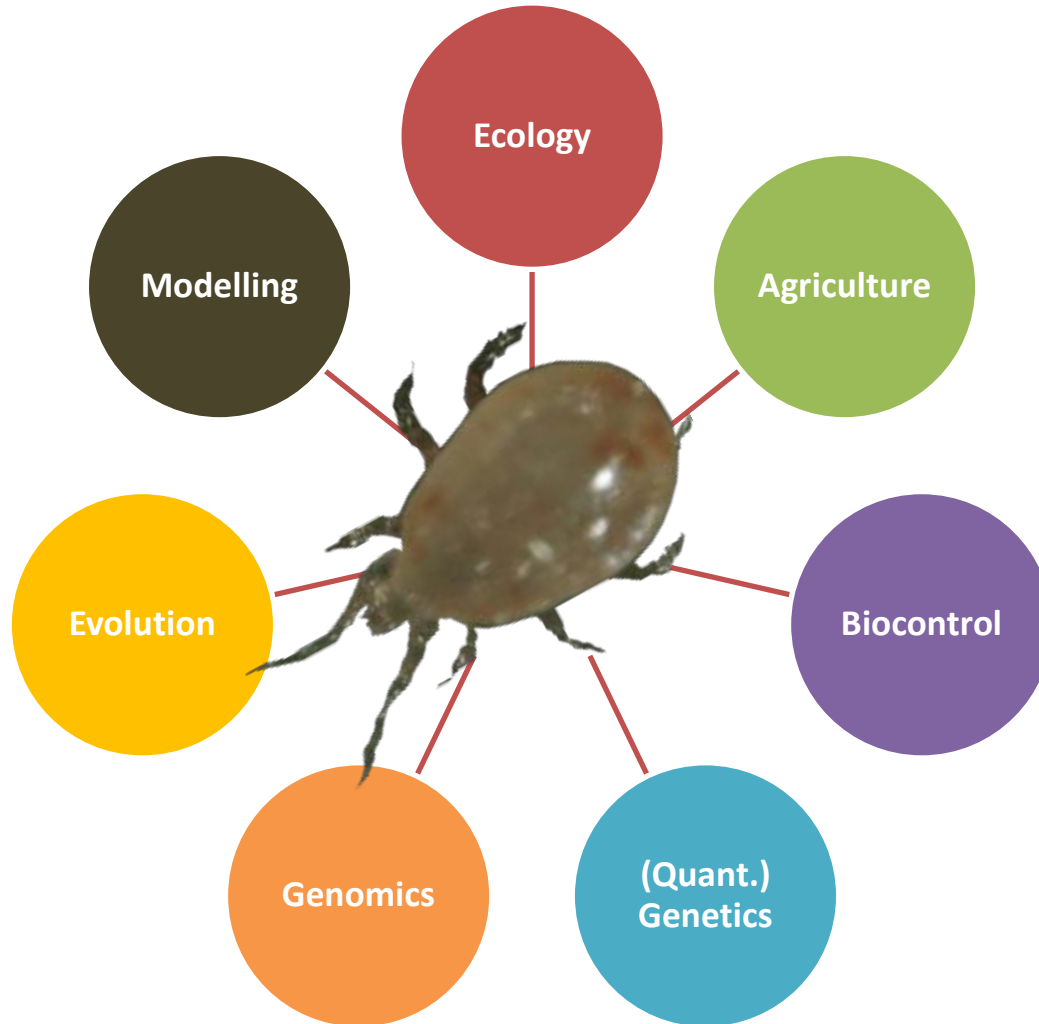
DOI: 10.1111/eea.12510

**SPECIAL ISSUE - IMPROVING PEST CONTROL:
MASS REARING AND FIELD PERFORMANCE**

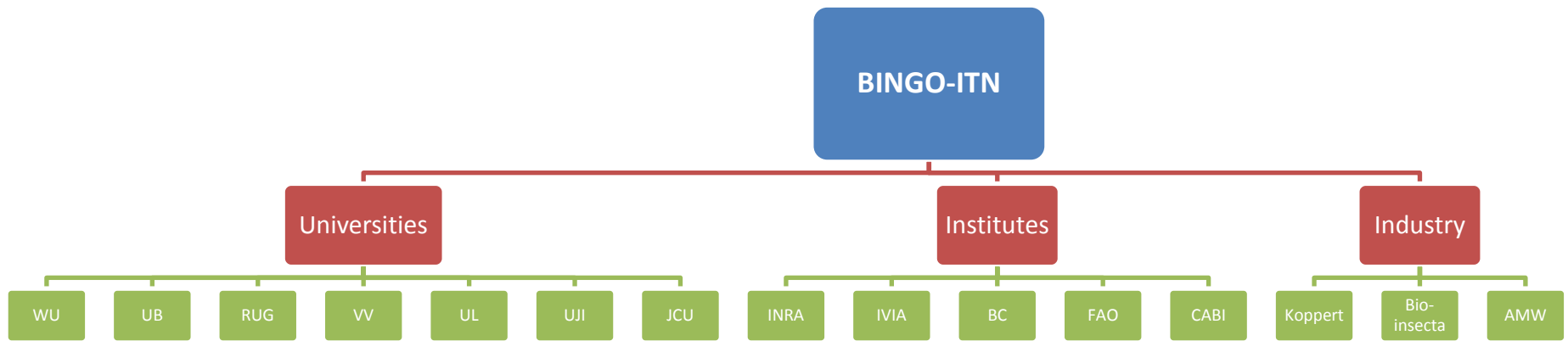
**It is time to bridge the gap between exploring and
exploiting: prospects for utilizing intraspecific genetic
variation to optimize arthropods for augmentative pest
control – a review**

Suzanne T.E. Lommen^{1§#}, Peter W. de Jong^{2#} & Bart A. Pannebakker^{3*}

Interdisciplinary by nature



BINGO - participants



BINGO - participants



24 researchers

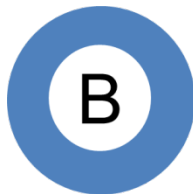
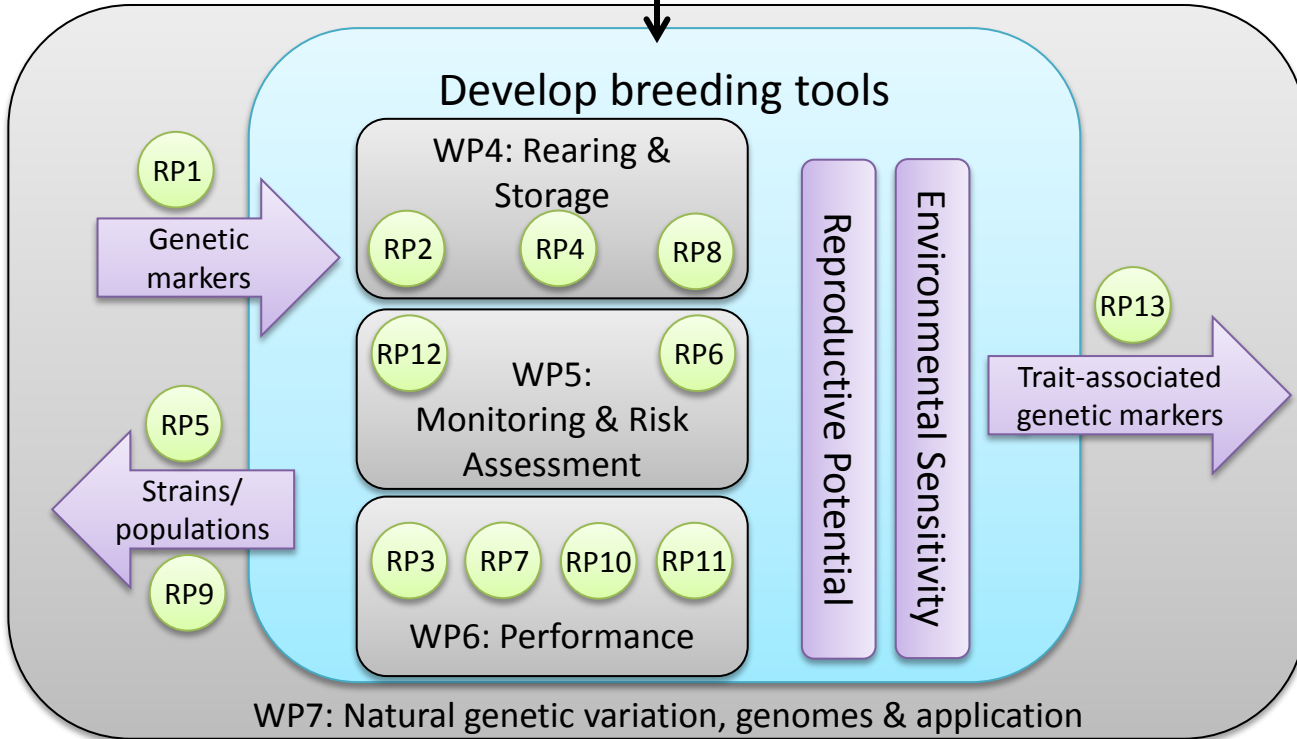


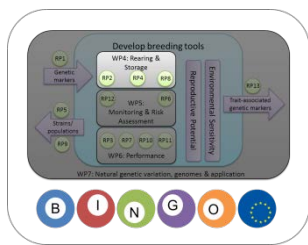
13 PhD students (ESRs)

Natural genetic variation



Challenges in Integrated Pest Management (IPM)








WP4 – Rearing and storage



Kostas Bourtzis
FAO

Research Objectives

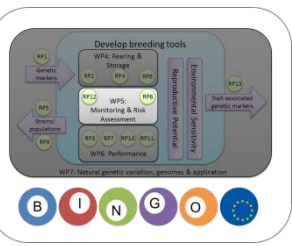
- Formulate general principles for mass rearing and storage of biocontrol agents
- Explore alternative mass rearing approaches that maintain desirable trait phenotypes

| RP no | Project title | ESR | Host |
|-------|---|---|------|
| RP2 | Fecundity & scales in <i>Ephesia</i> | Sander Visser  | BC |
| RP4 | Clutch size, sex ratio, and differential mortality in the <i>Bracon hebetor</i> / <i>B. brevicornis</i> species complex | Simone Ariens  | UB |
| RP8 | Optimization of mass rearing of <i>Bactrocera oleae</i> and its parasitoids | Erica Ras  | FAO |

WP5 – Monitoring and Risk assessment

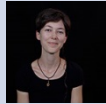



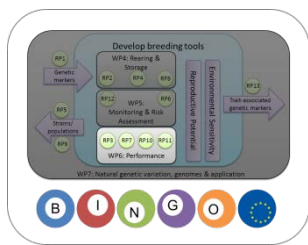
Tim Haye
CABI



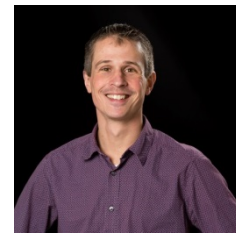
Research Objectives

- Quantify the risk of non-target effects of inundatively released egg parasitoids
- Monitor persistence of released biocontrol agents and potential risks of replacements of con-generic or non-related species

| RP no | Project title | ESR | Host |
|-------|---|--|------|
| RP6 | Benefits and risks of using the native polyphagous biological control agent, <i>Anastatus bifasciatus</i> , against invasive stink bug <i>Halyomorpha halys</i> | Judith Stahl  | CABI |
| RP12 | Monitoring pre- and post-release diversity in local parasitoid populations | Sophie Chattington  | UB |







WP6 – Performance



Tom Groot Koppert

Research Objectives

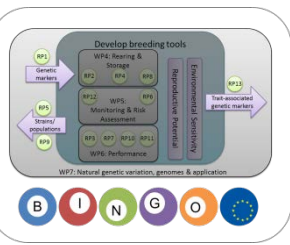
- Generate a mathematical modeling framework for predicting key biocontrol agent performance traits
- Artificial selection on predicted performance traits in three biocontrol agents,
- Test success of using artificial selection to increase performance

| RP no | Project title | ESR | Host |
|-------|---|---|------|
| RP3 | Promoting adaptability of <i>Amblyseius swirskii</i> predatory mites to tomato crop | Angeliki Paspatis  | IVIA |
| RP7 | Improving pest control efficiency: a modelling approach | Wouter Plouvier  | INRA |
| RP10 | Minimizing plant damage through selected <i>Nesidiocoris tenuis</i> | Milena Chinchilla Ramírez  | IVIA |
| RP11 | Expanding the range of uses of <i>Phytoseiulus persimilis</i> predatory mites | Sophie le Hesran  | KBV |

WP7 – Natural genetic variation genomes & application







Bas Zwaan
WU



Research Objectives

- Develop genome-wide genetic markers for field monitoring, for estimating and tracking variation mass-reared biocontrol agent strains
- Unravel the genes that underlying phenotypic variation in relevant biocontrol agent traits
- Develop genomic selection methods for improvement of biocontrol agents

| RP no | Project title | ESR | Host |
|-------|---|---|------|
| RP1 | Population genomics of natural enemies | Kim Ferguson  | WU |
| RP5 | Genomic basis of life history traits and reproductive potential | Kelley Leung  | RUG |
| RP9 | The genetic basis of diapause in natural <i>Drosophila melanogaster</i> populations | Manolis Lirakis  | VV |
| RP13 | Genome-based selection for the improvement of natural enemies in biocontrol | Shuwen Xia  | WU |

BINGO –Training & Dissemination

- BINGO Summer Schools:
 - Research skills, Professional skills & Careers
- BINGO Workshops:
 - Genomics & evolution in invertebrates (2018)
 - Integrating genetics & biocontrol: from lab to market (2018)
- Outreach:
 - Professionals
 - Public
 - High school students



Andra Thiel
UB



Leo Beukeboom
RUG



B I N G O



More information?

Visit BINGO website:

- <http://www.bingo-itn.eu/>
- Sign up for BINGO newsletter



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Contact BINGO: info@bingo-itn.eu



Margreet Bruins



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