GLOBAL BIOECONOMY SUMMIT 2015

Natural History Museums & BGCI Workshop: Bioeconomy & Biodiversity

Chairs: **Johannes Vogel**, German Bioeconomy Council &
Stephen Blackmore, BGCI

Biodiversity for a sustainable Bioeconomy

Professor Johannes Vogel, Ph.D.
Museum für Naturkunde, Berlin
German Bioeconomy Council

Leibniz-Gemeinschaft

museum für naturkunde berlin

Bioeconomy pionieers

- Hans Sloane 1660 - 1753
- Joseph Banks 1742 - 1820
- Alexander v. Humboldt 1769 – 1859

- All three closely associated with collections, Natural History Museums and Botanical Gardens

museum für
naturkunde
berlin

Network Natural History Collections: Museums and Gardens

Leibniz-Gemeinschaft

museum für naturkunde berlin

Capacity and capability
(13 largest EU & NA NHM’s)

- In capitals / major cities
- >550M specimen
- >3000 scientists
- $850M annual budget
- > 33M visitors

Excellent science, enormous collections, huge public reach

Leibniz-Gemeinschaft

museum für naturkunde berlin

Biodiversity challenge

- 90% of human calories from **16 species**
- **1.8 million** species described
- At least **25 million species** on earth
- Major advances in
  - Ancient DNA technology
  - Genomics, proteonomics, metabolomics
  - IT / computing

Information in collections NOW available

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Shark tales

Shark tales – sport, art, what next?

Damien Hurst, Tate Modern

Speedo sharkskin swimsuit

19th century shark, AUS

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Biodiversity as global scientific infrastructure




- Billions of objects
- Globally distributed
- 300 years of efforts
- Huge expertise & skills
- Discoveries galore
- Common goals
- Renewing ‚contract'

The challenge

Linking biodiversity science to a sustainable bioeconomy

Leibniz
Leibniz-Gemeinschaft

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The Gardens By The Bay, Singapore

Plant Diversity & Botanic Gardens

Stephen Blackmore

BGCI
Plants for the Planet

INNOVATION, GROWTH AND SUSTAINABLE DEVELOPMENT

GLOBAL BIOECONOMY **SUMMIT 2015**

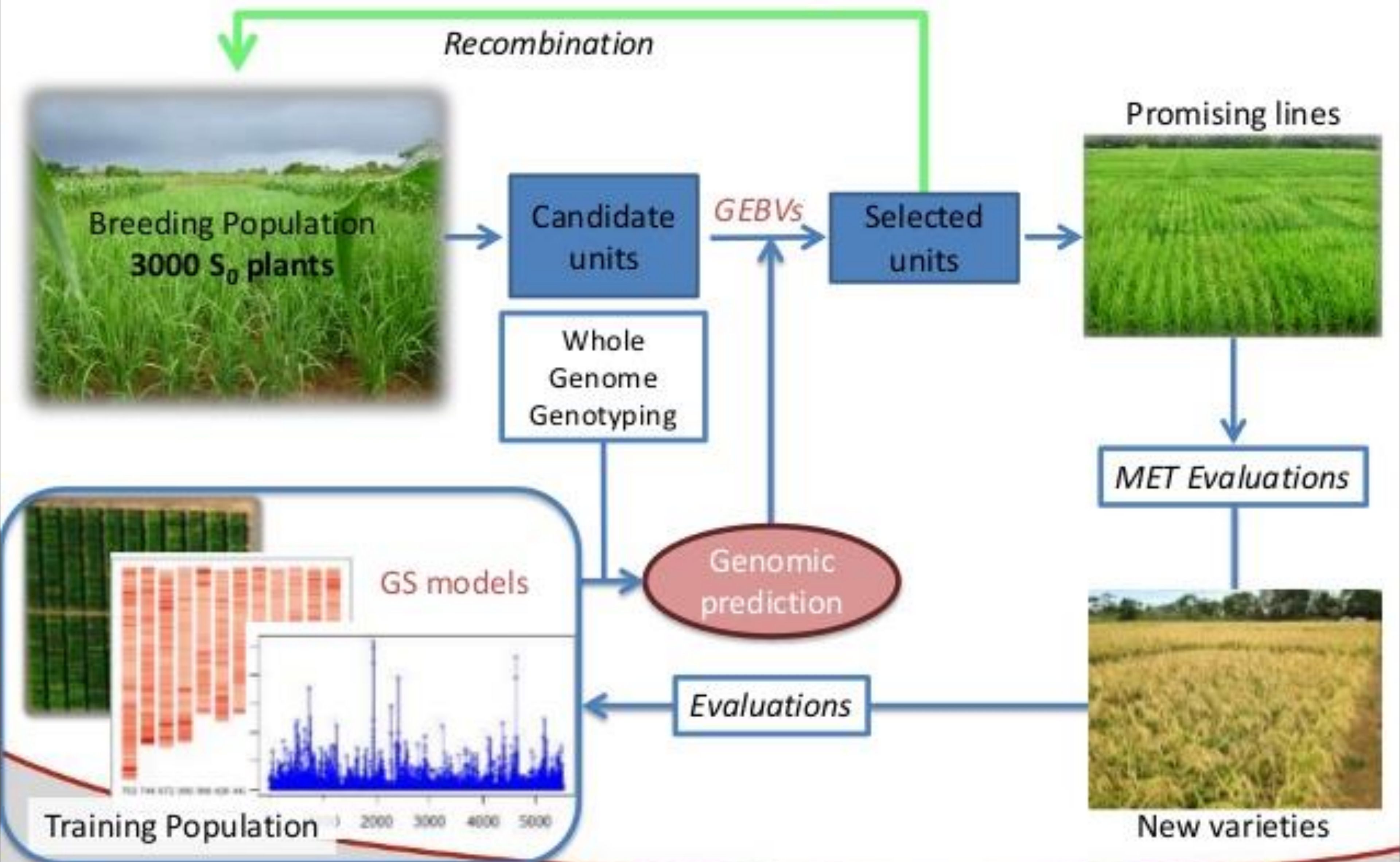
GLOBAL BIOECONOMY SUMMIT 2015

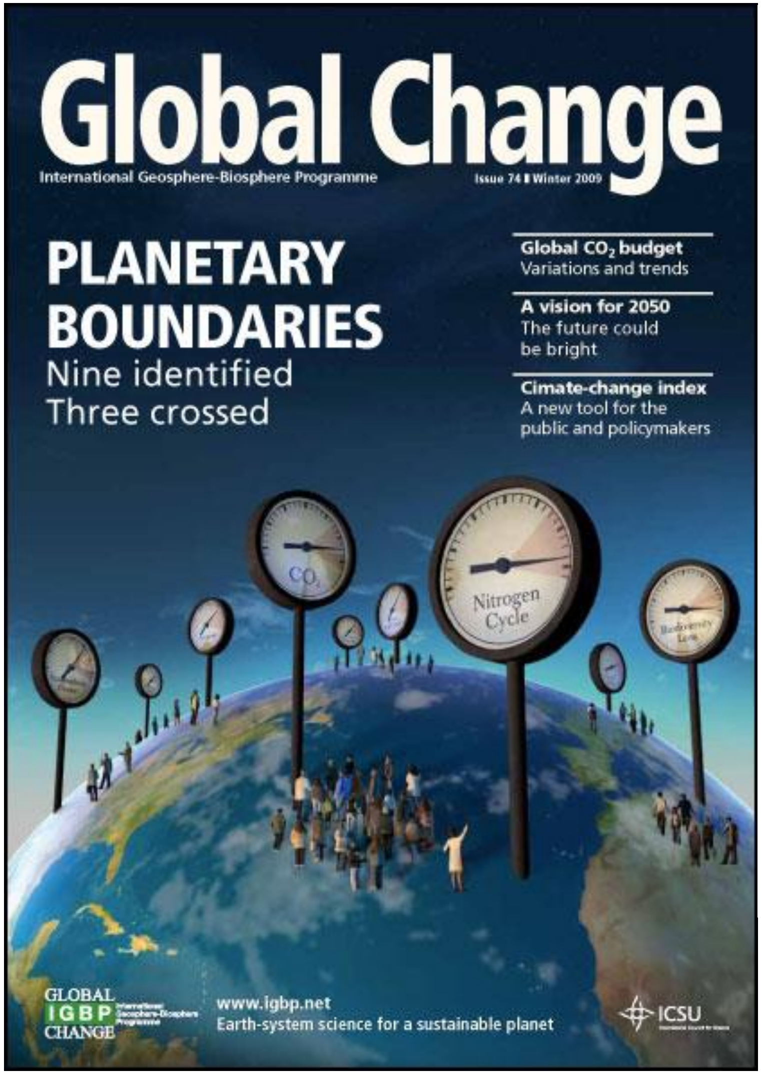
Replica of 31,000 year old paintings in the Chauvet Cave from the Anthropos Museum, Brno

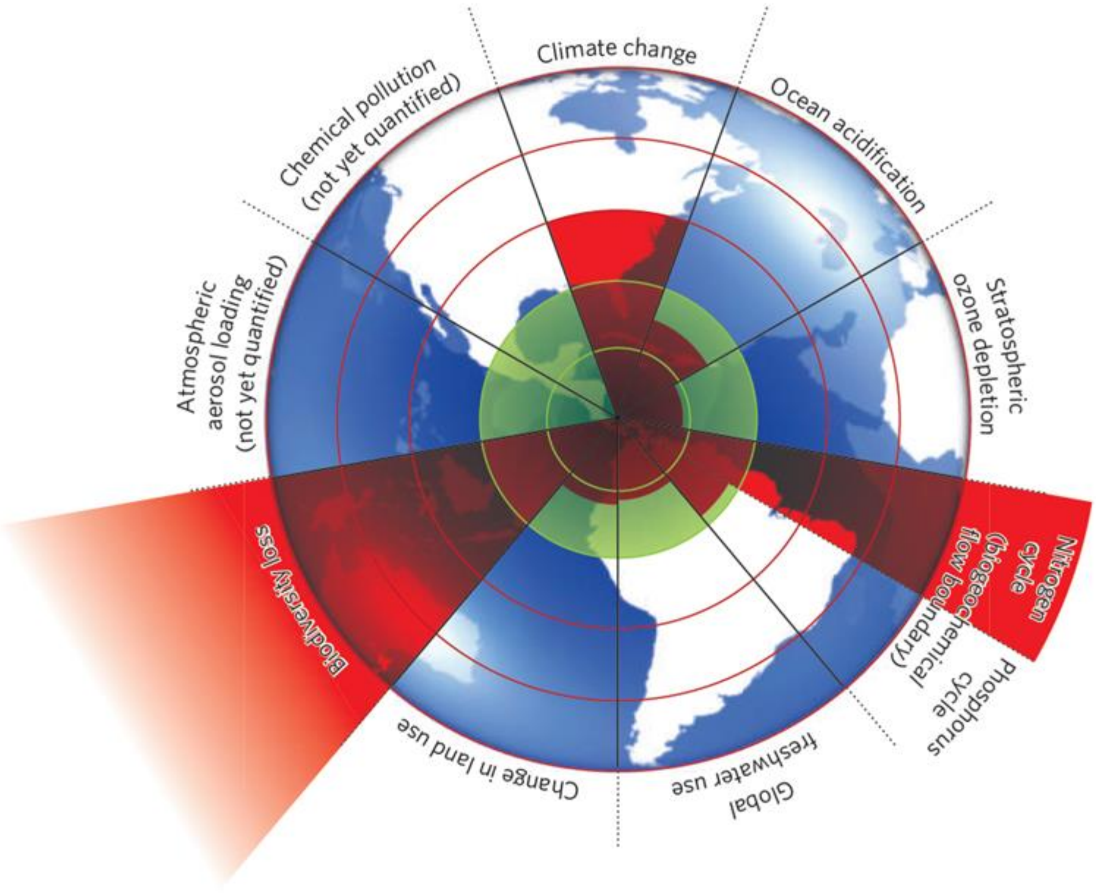
Wheat (*Triticum aestivum*)

Chinese traditional medicine, Xishuangbanna, China

The RGS breeding scheme



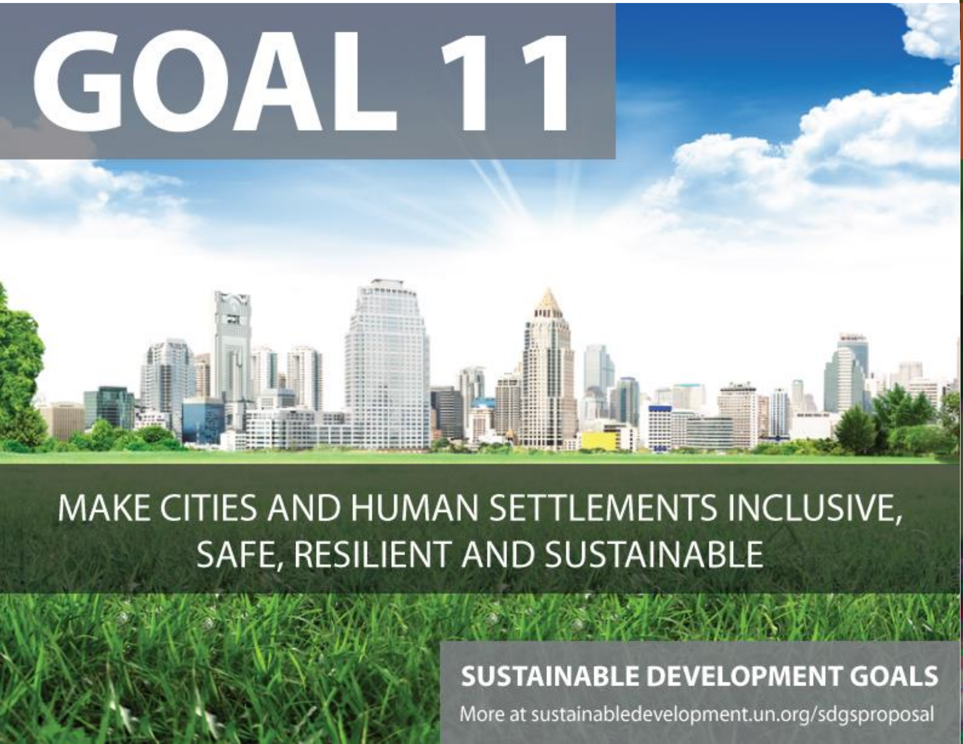




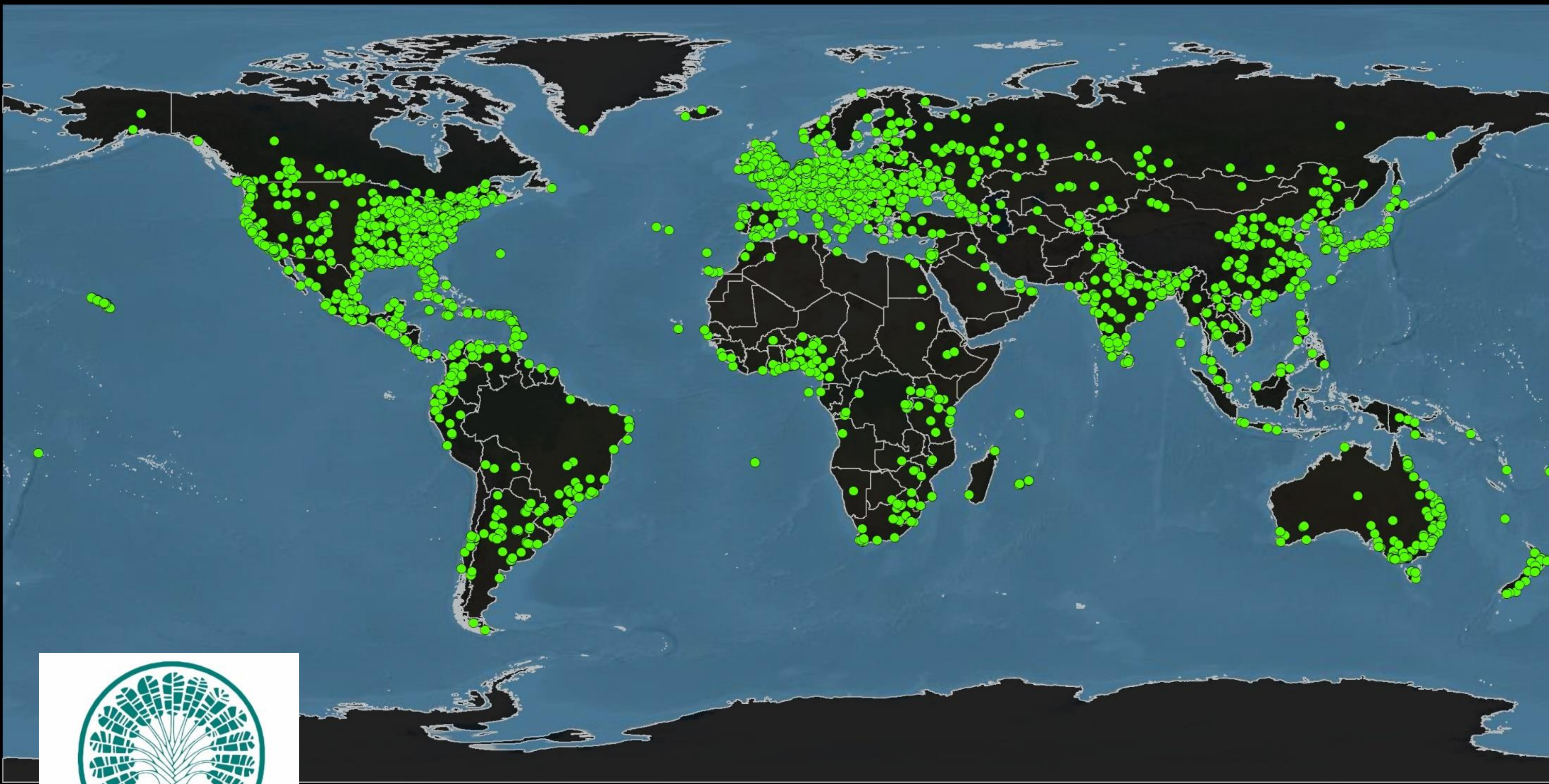
Rockström, J. et al. (2009) A safe operating space for humanity. Nature 461:472-475.


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS


GOAL 2
END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE
SUSTAINABLE DEVELOPMENT GOALS


GOAL 11
MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE
SUSTAINABLE DEVELOPMENT GOALS
More at sustainabledevelopment.un.org/sdgsproposal


GOAL 15
PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, AND HALT AND REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS
SUSTAINABLE DEVELOPMENT GOALS
More at sustainabledevelopment.un.org/sdgsproposal



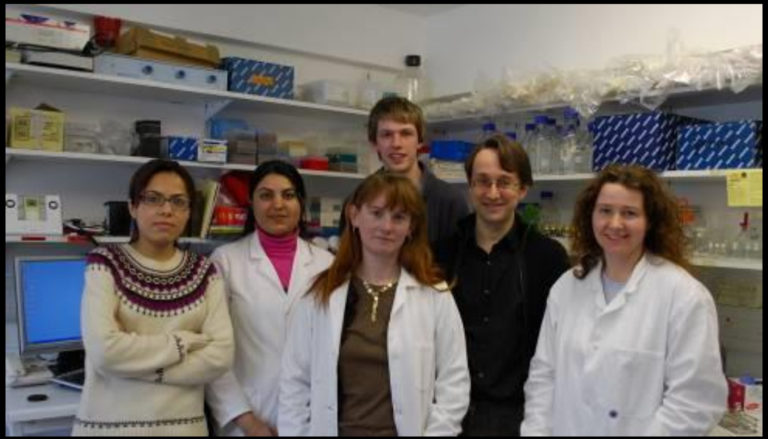
BGCI

Plants for the Planet

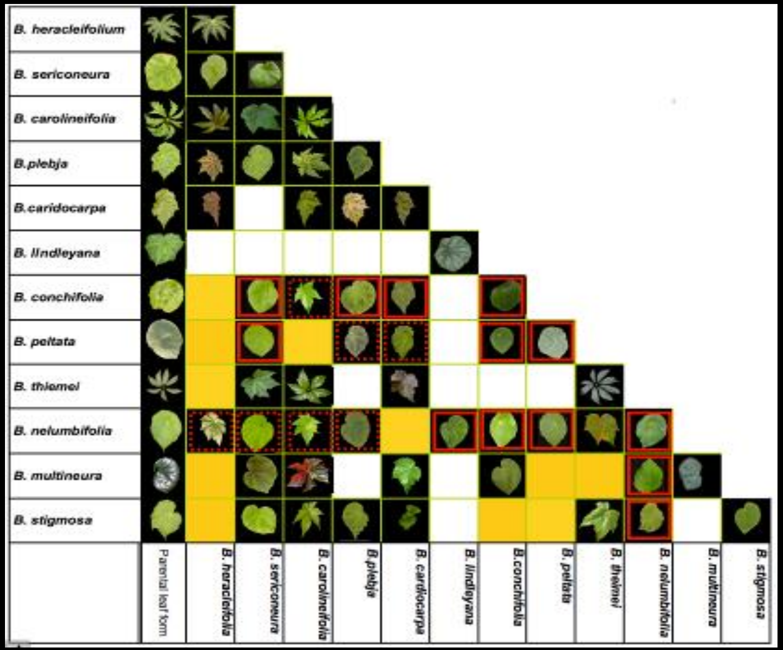

RBGE
Living Collections
34,442 accessions
17,257 taxa
Vireya rhododendrons at RBGE

RBGE
Preserved Collections
3 million
herbarium specimens

The evolution of developmental diversity in *Begonia*



Catherine Kidner's Lab at RBGE



Acorns of a rare subtropical oak (*Cyclobalanopsis* species), Hong Kong

Building a Global System for the conservation and use of all plant diversity

Dr Paul Smith, Secretary General,

Botanic Gardens Conservation International

Diminishing plant diversity




20% of plant species are threatened with extinction

Why plant diversity is important

Plant-based solutions are required to address all of the major environmental challenges:

- Food security
- Water scarcity
- Energy
- Human health
- Biodiversity conservation
- Climate change

Why plant diversity is important

Plant diversity enables human innovation, adaptation and resilience

The role of botanic gardens

Botanic gardens are uniquely placed to conserve and manage plant diversity. We can:

- Find plants using herbarium records
- Identify plants with our floras and expertise
- Conserve plants in seed banks, tissue culture, gardens and *in situ*.
- Restore habitats and reintroduce plant species
- Manage diverse species assemblages in diverse landscapes

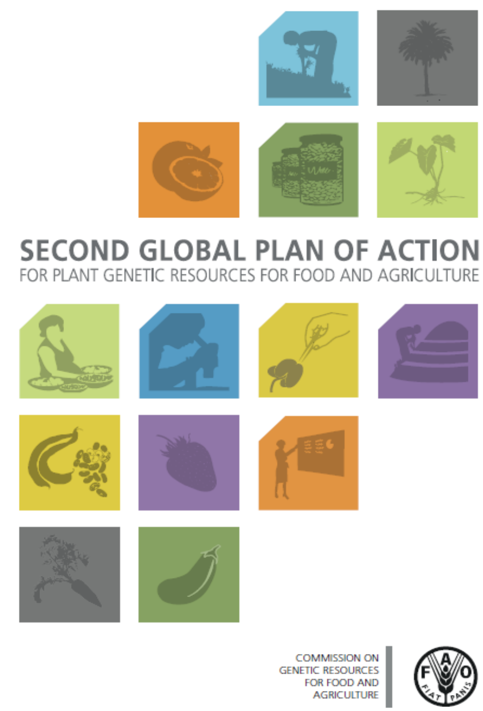
The role of botanic gardens

There is no technological reason why any plant species should become extinct

BGCI
Plants for the Planet

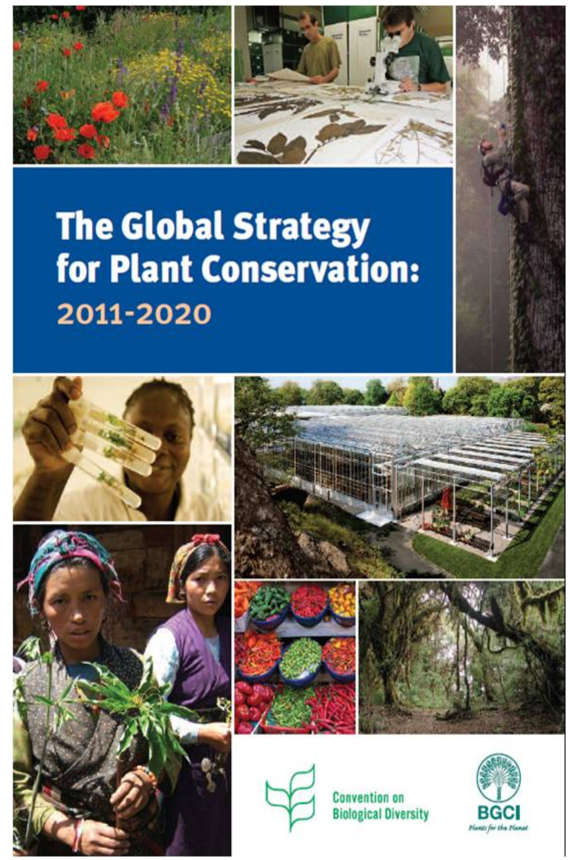
A rational, cost-effective Global System: crop diversity

- The International Treaty on PGRFA
- A Global Plan of Action for PGRFA
- A review process (FAO SOWPGRFA)
- A network of international institutions and *ex situ* collections
- A global portal of accession-level data (Genesys)
- A universal gene bank information management system (GRIN Global).
- Advanced bioinformatics tools that allow users to mine crop characterisation data (DIVSEEK)

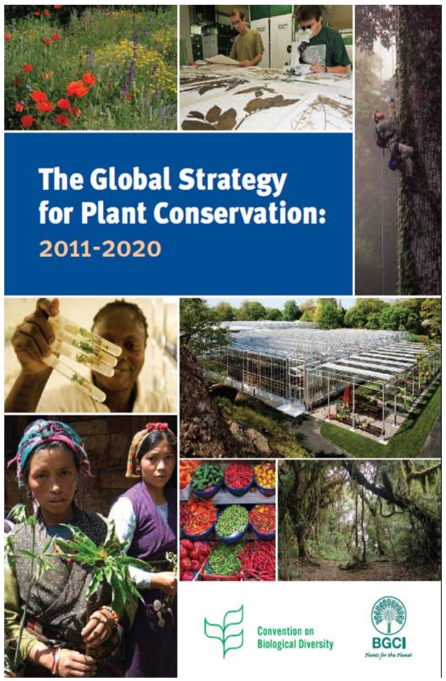


A rational, cost-effective Global System: botanic gardens

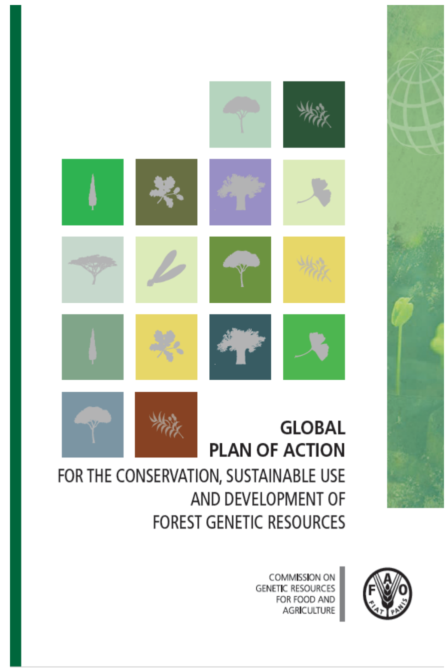
- The Convention on Biological Diversity
- The Global Strategy for Plant Conservation
- A review process (GPPC/BIP)
- A network of international institutions and *ex situ* collections (BGCI)
- A global portal of accession-level data (PlantSearch)
- A universal accessions information management system
- Advanced bioinformatics tools that allow users to mine characterisation data

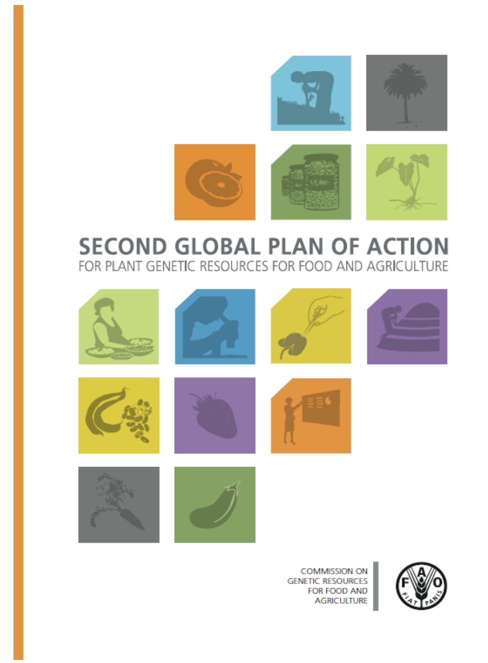


A rational, cost-effective Global System: policy frameworks



Convention on Biological Diversity





BGCI

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A rational, cost-effective Global System: infrastructures

Garden Search

Locate botanic gardens around the world

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A rational, cost-effective Global System: collections

- PlantSearch: ca.1.3 million accessions from 1099 botanic gardens
- Total number of accepted plant *species*: 115,787*
- Estimated *minimum* proportion of total plant diversity in botanic gardens & arboreta: 33.02%

Caveats:

- PlantSearch is not comprehensive and records are not always up to date;
- Accessions are sometimes wrongly named;
- Accession records tell us little about the *conservation value* of collections

*Compared against The Plant List Version 1.1 (2014). http://www.theplantlist.org/

A rational, cost-effective Global System: technical expertise

BGCI
Plants for the Planet

pca
Plant Conservation Alliance

NEW ENGLAND WILD FLOWER SOCIETY

NEW ZEALAND PLANT CONSERVATION NETWORK

AUSTRALIAN SEEDBANK PARTNERSHIP

SEEDS OF SUCCESS

Center for PLANT Conservation
Conserving and restoring America's native plants

bg anz

MILLENNIUM SEED BANK PARTNERSHIP
Kew

ENSCONET
European Native Seed Conservation Network

EUROPEAN BOTANIC GARDENS CONSORTIUM

ECOLOGICAL RESTORATION ALLIANCE OF BOTANIC GARDENS

The Australian Network for Plant Conservation Inc.
working to save Australia's native plants

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Plants for the Planet

A rational, cost-effective Global System: How are we doing?

- An estimated 39% of threatened species are conserved *ex situ* in the USA, 56% in Australia/NZ and 64% in Russia.

- An estimated 50.5% of European threatened plant species are held in seed banks (ENSCONET)

- An estimated 71% of European threatened plant taxa are conserved *ex situ* (but a third of these are in a single collection).

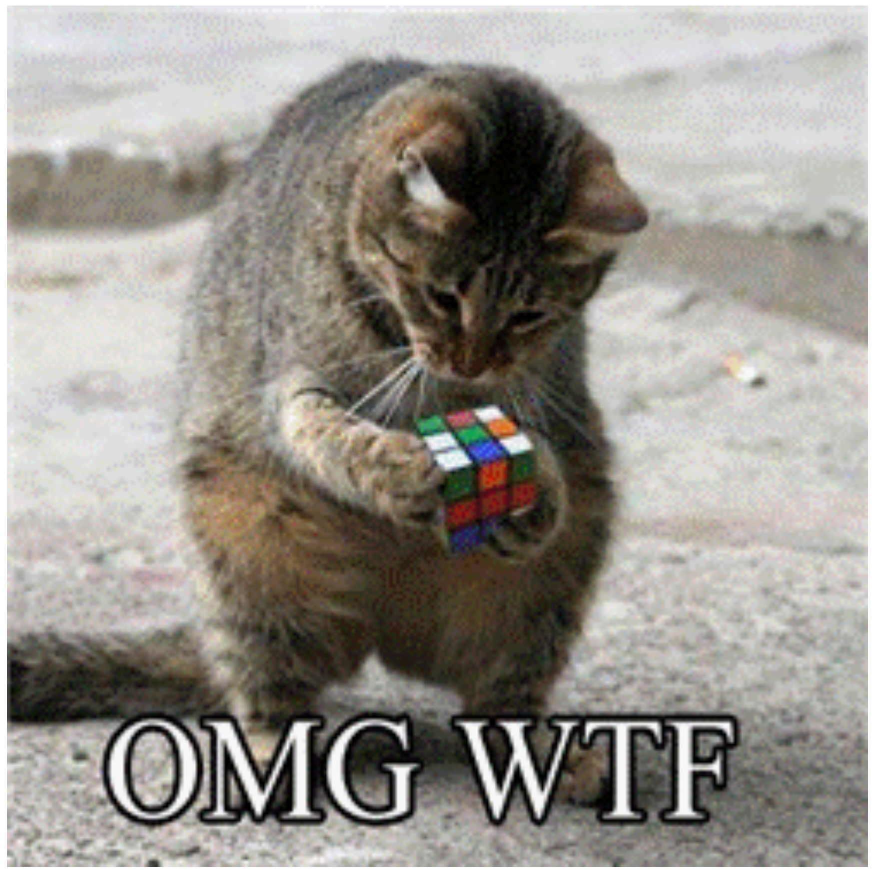
ENSCONET
European Native Seed Conservation Network

Building the Global System: how BGCI can help

- Promote the role of botanic gardens to policymakers and funders in delivering a botanic garden–centred, rational, cost-effective Global System for the conservation and use of all plant diversity.
- Co-ordinate efforts, and target resources and support where there are knowledge gaps.
- Knowledge hub: Build technical capacity in the botanic garden sector in plant conservation policy, practice and education. Clearing house for best practice, training, resources and expertise.
- Funding: Mobilise funding and partnerships to *deliver* plant conservation.

Conclusions

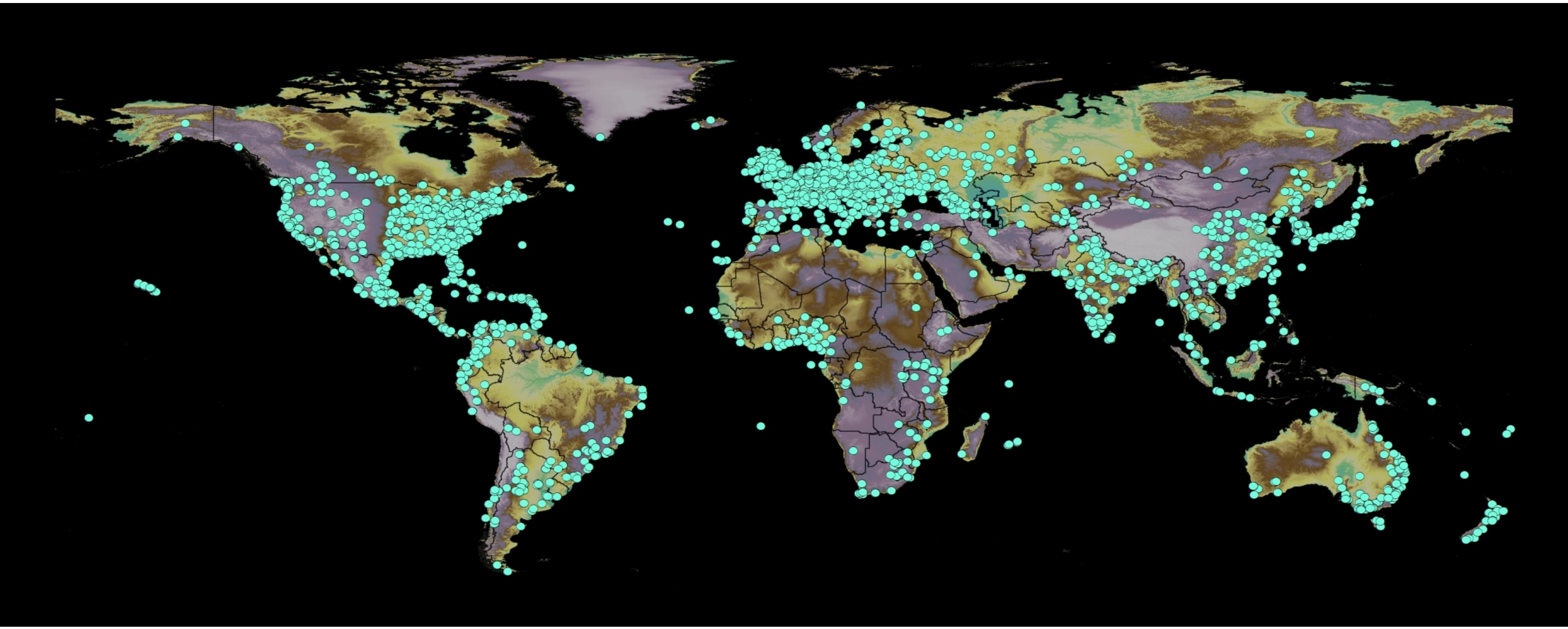
Botanic gardens, as a professional community, have unique knowledge and skills to find, identify, conserve and manage plant diversity in the landscape



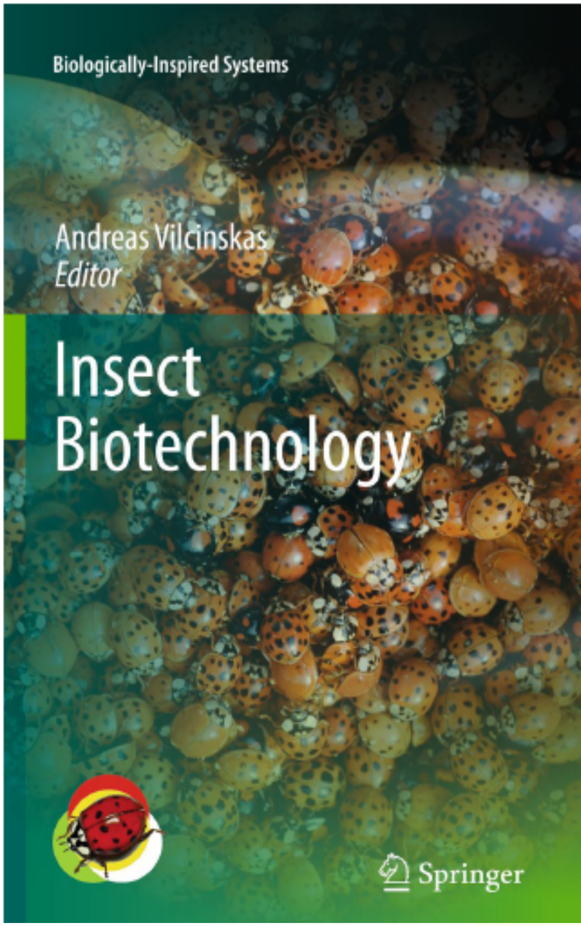
Conclusions

Botanic gardens need to show greater leadership in conserving and managing plant diversity

Thank you



http://www.bgci.org/joinin/members/




Insects as a resource for medicine, plant protection and biotechnology

Andreas Vilcinskas
Institute for Insect Biotechnology at the Interdisciplinary Research Center (IFZ)
Justus Liebig-University Giessen

Fraunhofer Institute for Molecular Biology and Applied Ecology
at the Technology and Innovation Center Giessen (TIG)

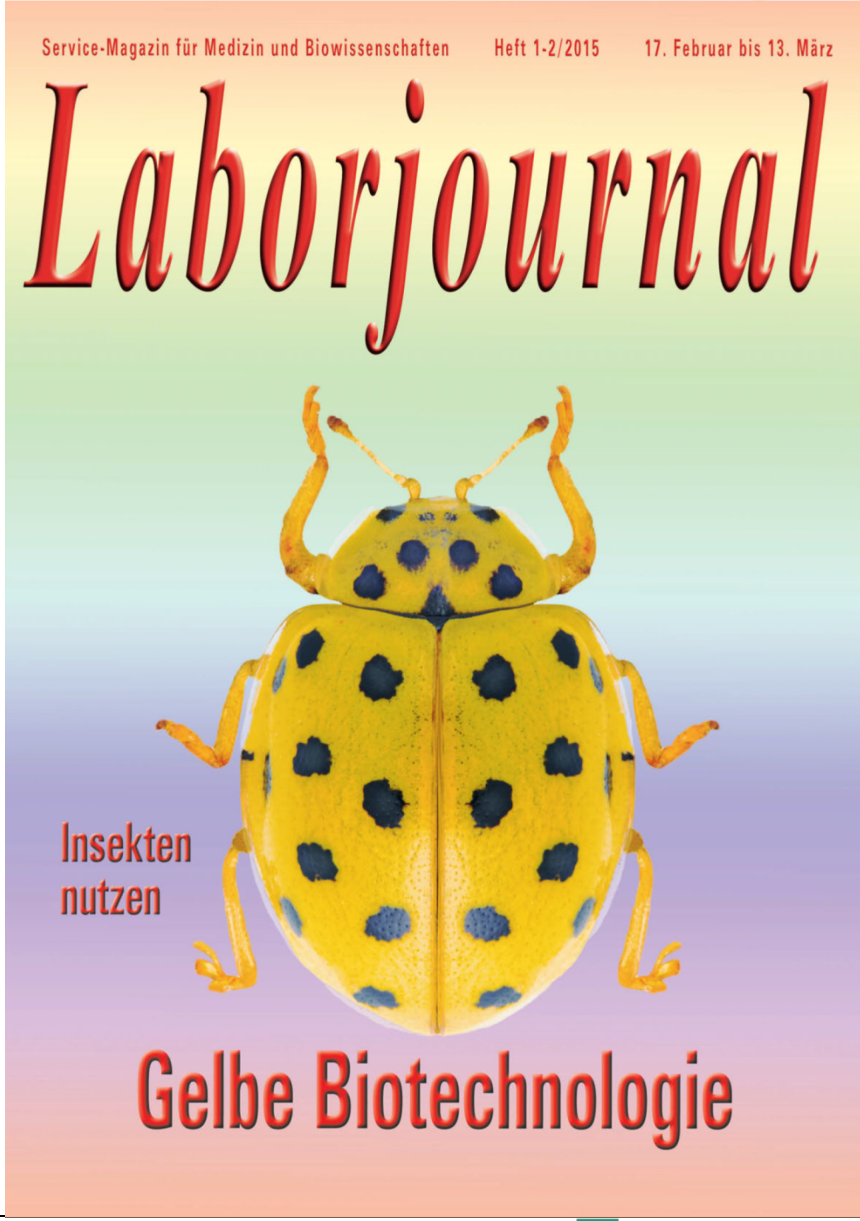
Insect Biotechnology

We define **Insect Biotechnology (Yellow Biotechnology)** as:

The application of biotechnological methods to translate insects, their molecules, cells, organs or associated microorganism, respectively, into products or services for specific use in medicine, agriculture or industry.

Translational research

Vilcinskas 2014: Encyclopedia of Biotechnology in Agriculture and Food



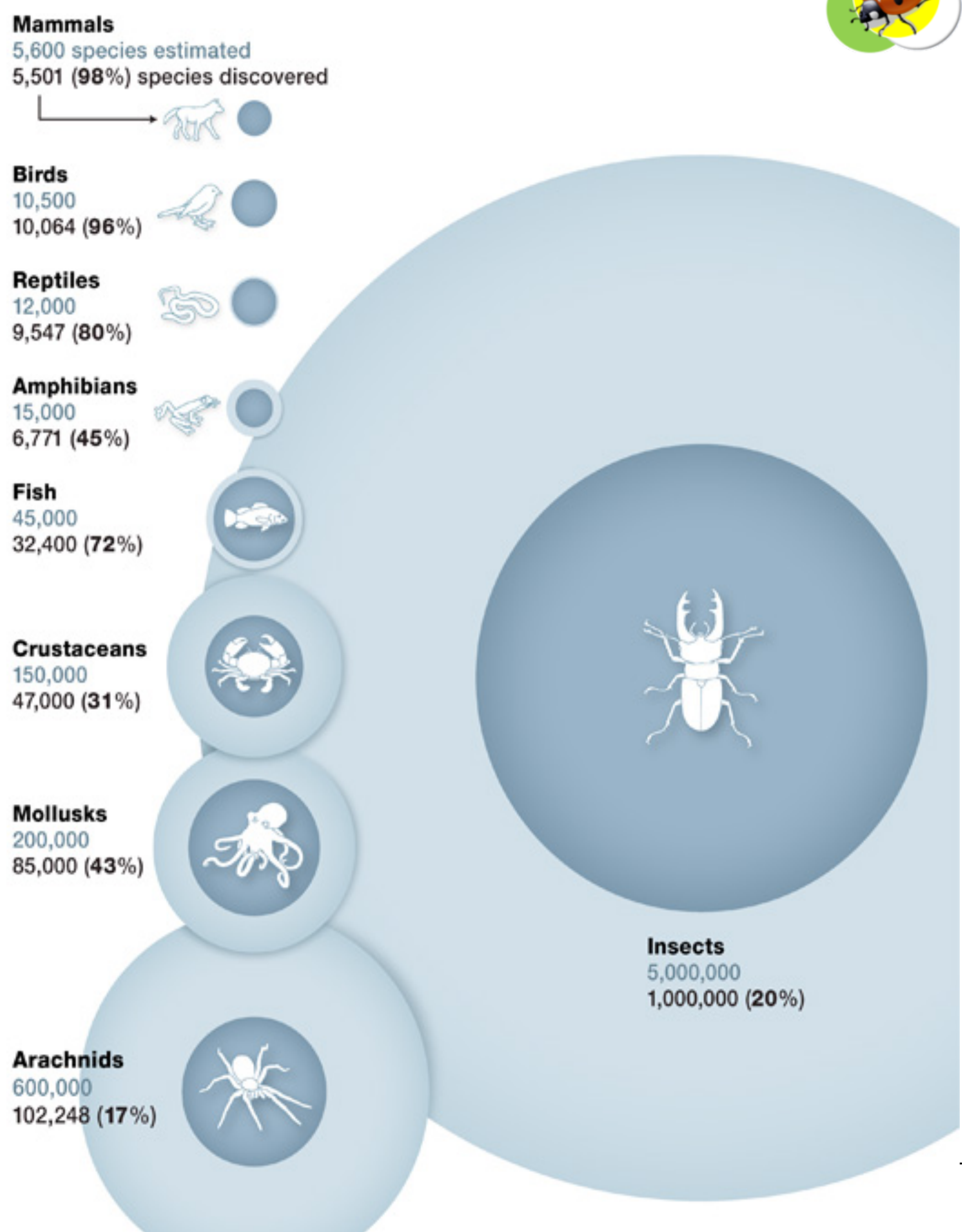
Lerning vom insects means learning how to win

Insects are the most diverse and, therefore, the evolutionarily most successfull group of organisms

Their biodiversity at species level can be expanded to the molecular level

Insects represent a incredible compound library

Insect Biotechnology aims to explore and to develop this compound library for human welfare.



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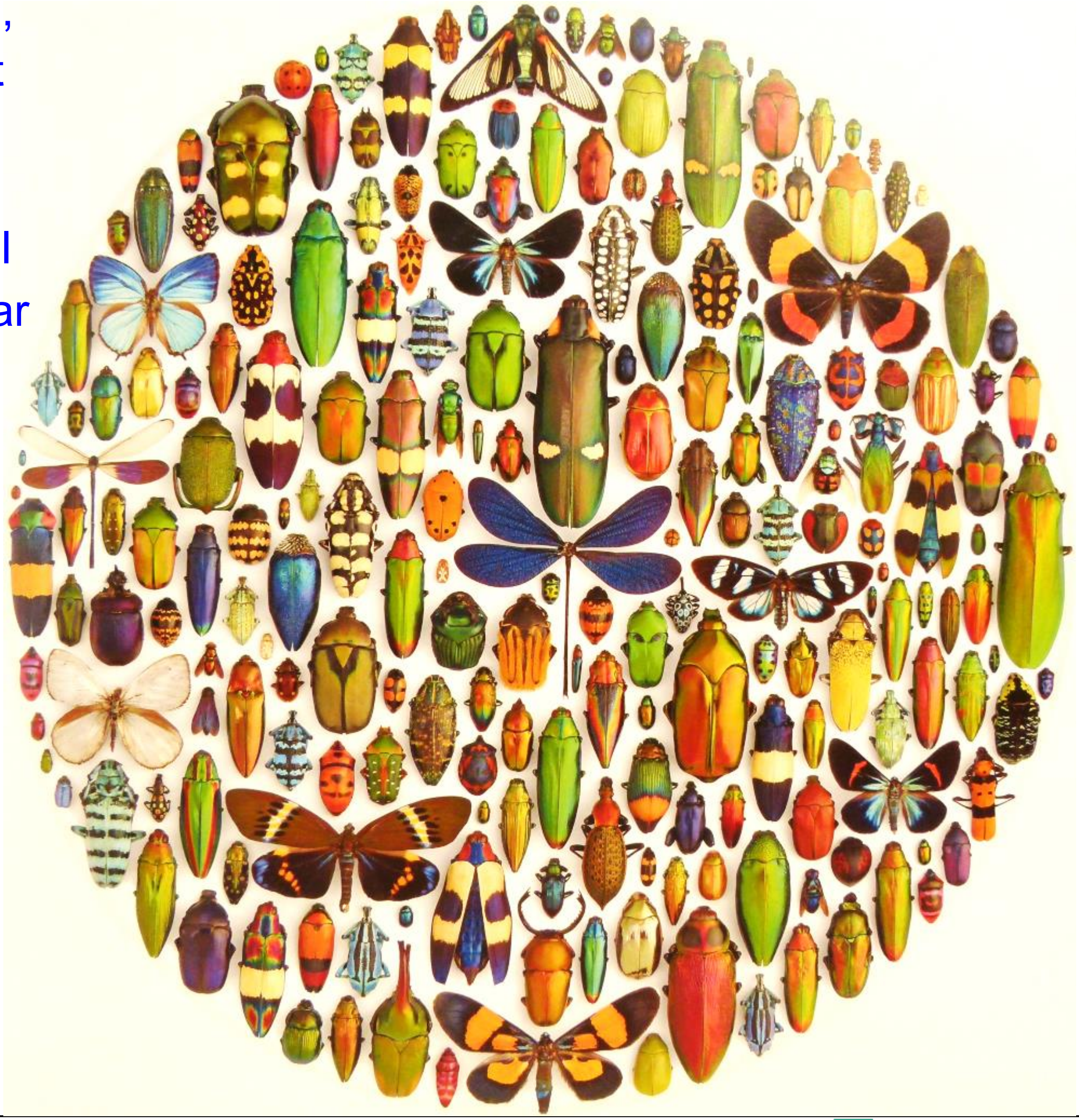


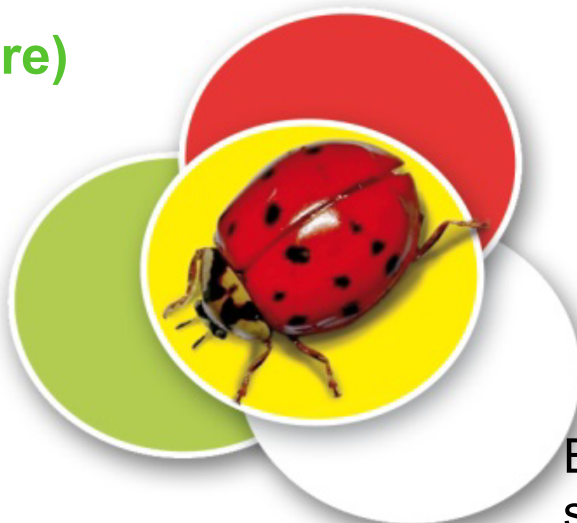
LOEWE-Center for Insect Biotechnology & Bioresources

Red biotech (health, medicine)

Anti-infectives (peptides, natural products)
Wound healing (enzymes, growth factors)
Surrogate host for human pathogens
Indicators of food safety
Novel food additives

Green biotech (agriculture)

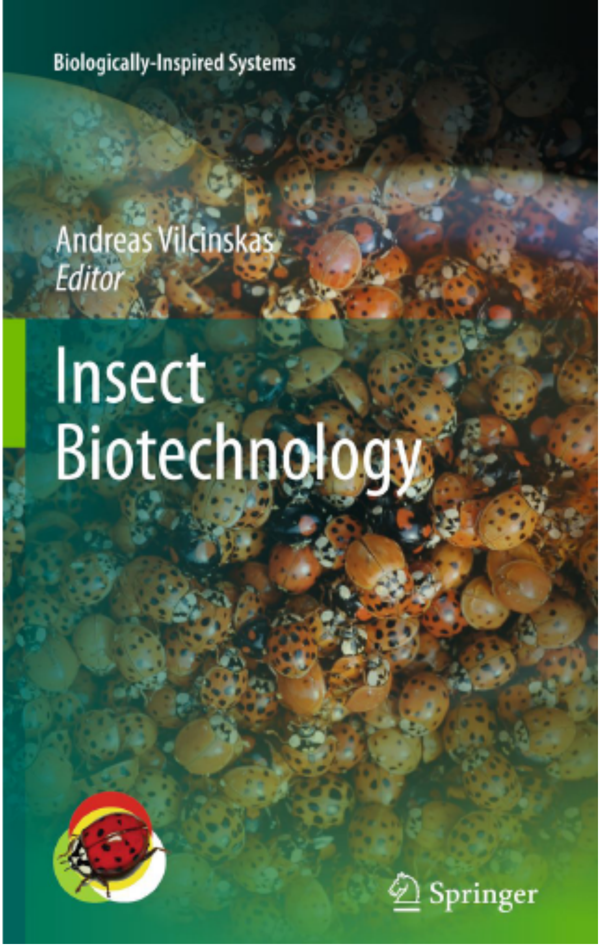
Insect-derived transgenes to engineer disease-resistant crops
RNAi-based plant protection

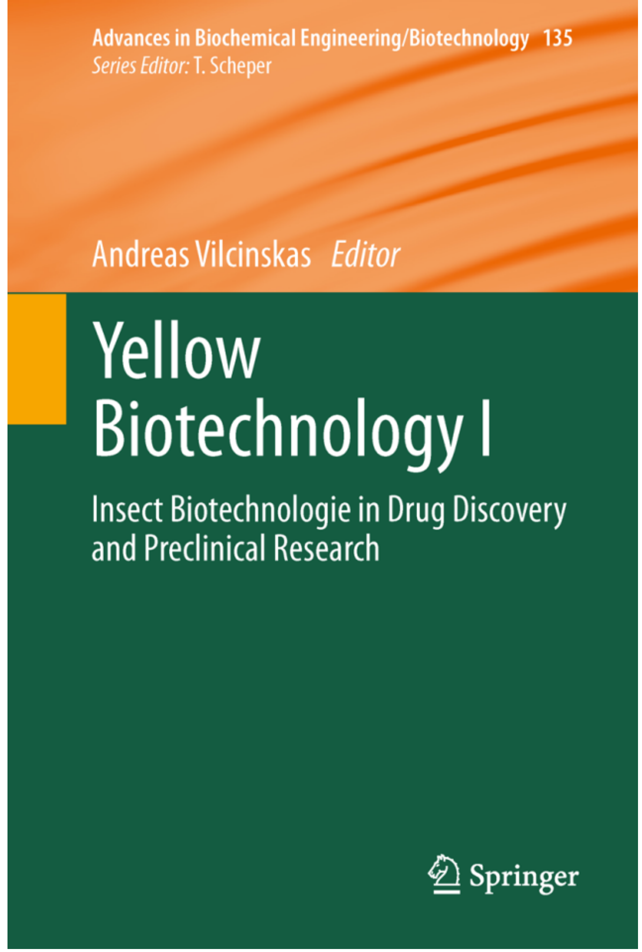


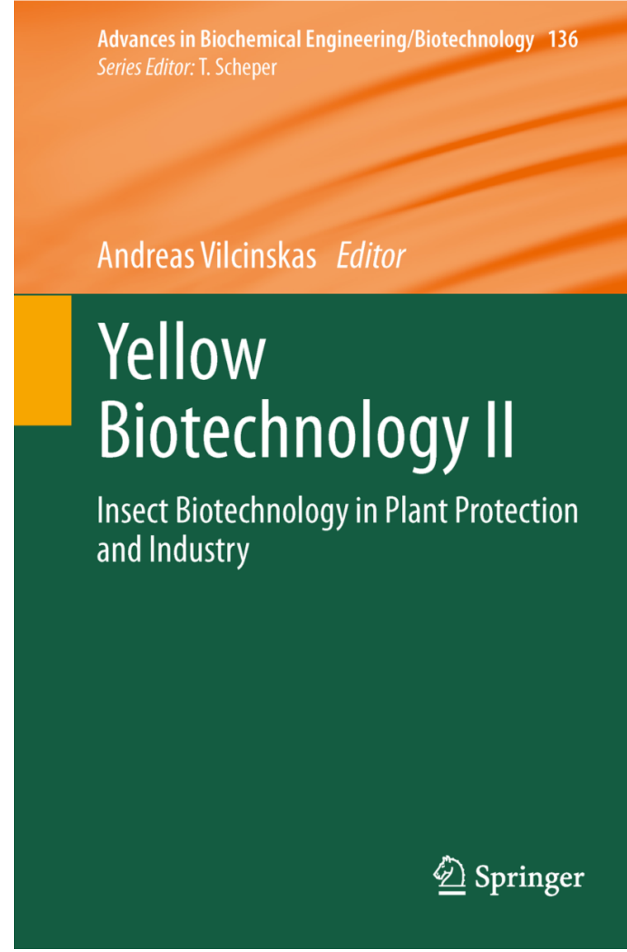
White biotech (industry)

Enzymes for chemical synthesis
Enzymes for waste processing
Cellulases and lignases (biofuels)
Biofilm degradation

LOEWE
Exzellente Forschung für Hessens Zukunft


Biologically-Inspired Systems
Andreas Vilcinskas
Editor
Insect
Biotechnology
Springer


Advances in Biochemical Engineering/Biotechnology 135
Series Editor: T. Scheper
Andreas Vilcinskas Editor
Yellow
Biotechnology I
Insect Biotechnologie in Drug Discovery
and Preclinical Research
Springer


Advances in Biochemical Engineering/Biotechnology 136
Series Editor: T. Scheper
Andreas Vilcinskas Editor
Yellow
Biotechnology II
Insect Biotechnology in Plant Protection
and Industry
Springer

Insects as a source for new therapeutics


Ameisen, Käfer und Co. sind die erfolgreichsten Tiere der Erde. Ihre Überlebensgene können auch dem Menschen helfen

Insekten auf Rezept

Sie krabbeln oder fliegen und sind uns meistens lästig. Doch Forscher wissen, dass in den Millionen Insektenarten der Erde eine riesige Apotheke schlummert – ihre Substanzen wirken oft besser als chemische Arzneien

Keine Sorge: Ameisen in Tablettenform muss auch in Zukunft niemand schlucken. Aber vielleicht werden die Tiere nützliche Wirkstoffe liefern

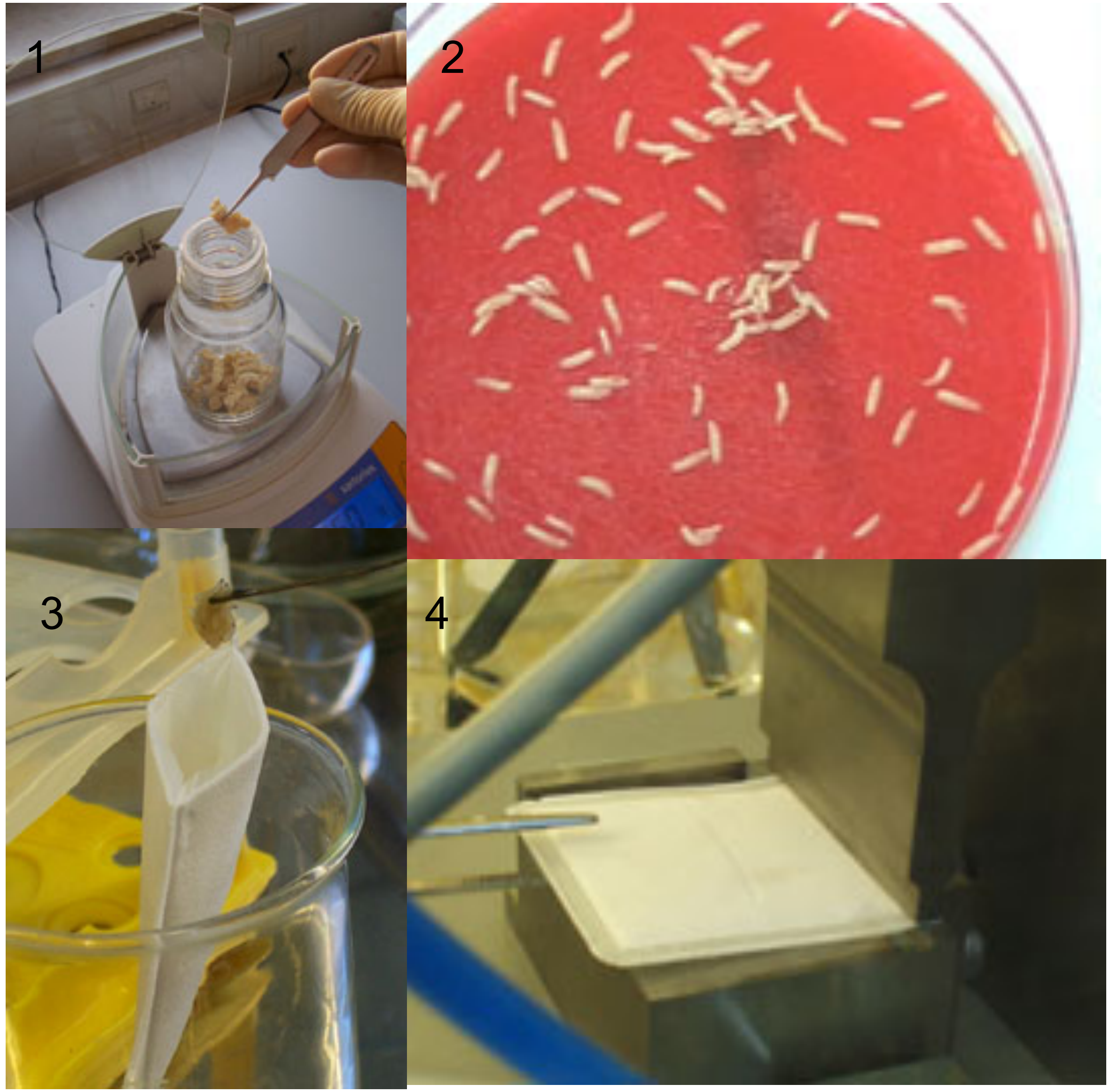
24 PM 03/2010

03/2010 PM 25

Insects as a source for new therapeutics

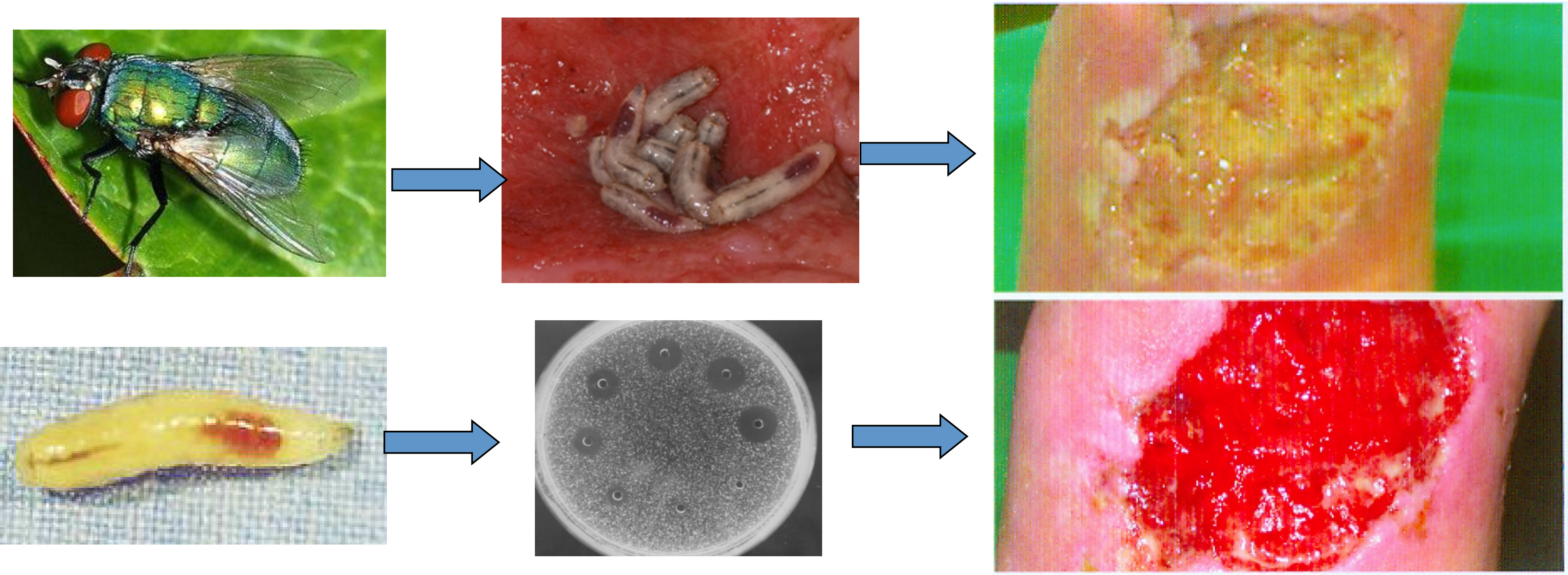
From Maggot Therapy to Biosurgery

The wound maggot
Lucilia sericata



From Maggot Therapy to Biosurgery

Lucilia sericata

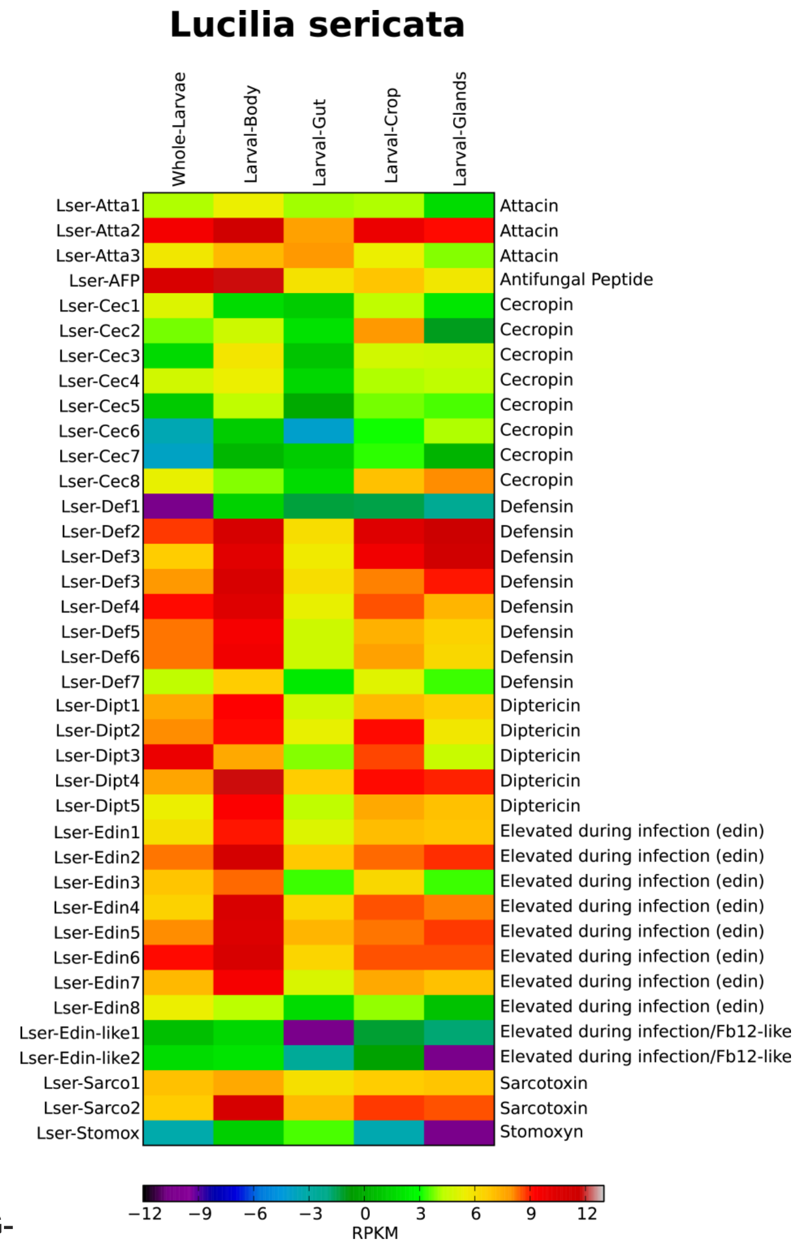


- Molecules accelerating wound healing
- antimicrobial peptides against MDR-bacteria
- enzymes that degrade necrotic tissue without impeding healthy ones

From Maggot Therapy to Biosurgery

Pöppel A-K, Vogel. H., Wiesner, J. and Vilcinskas A. 2015: Antimicrobial Agents and Chemotherapy

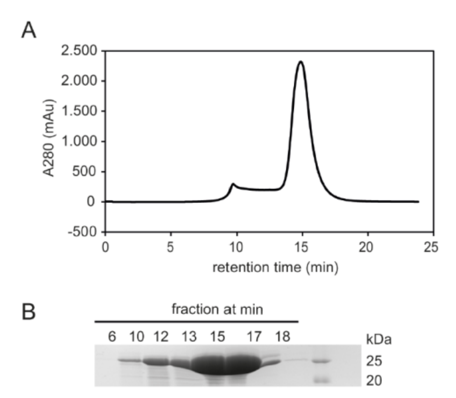
From Maggot Therapy to Biosurgery



Anne Pöppel

Discovery of Lucimycin

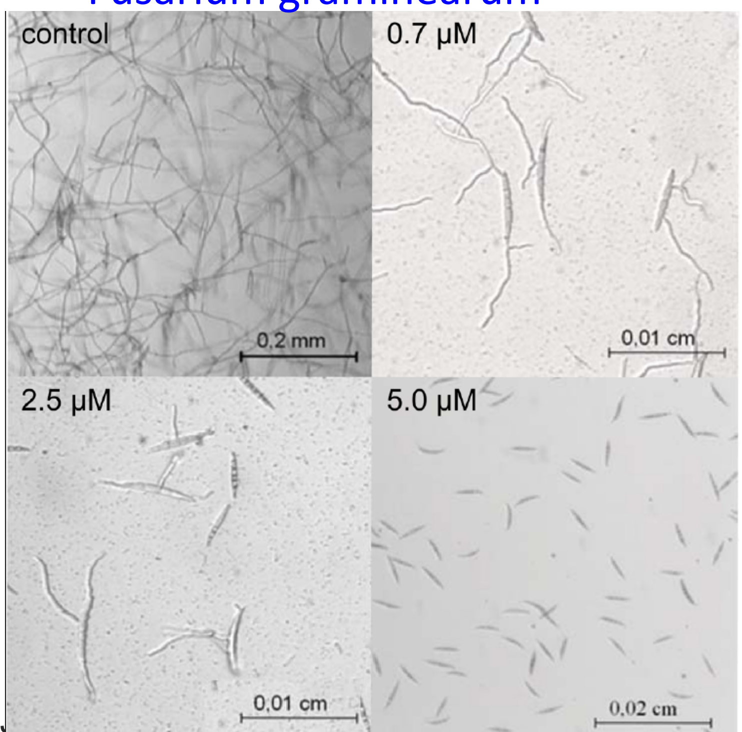
Identification of a novel antifungal peptide with potential in plant protection



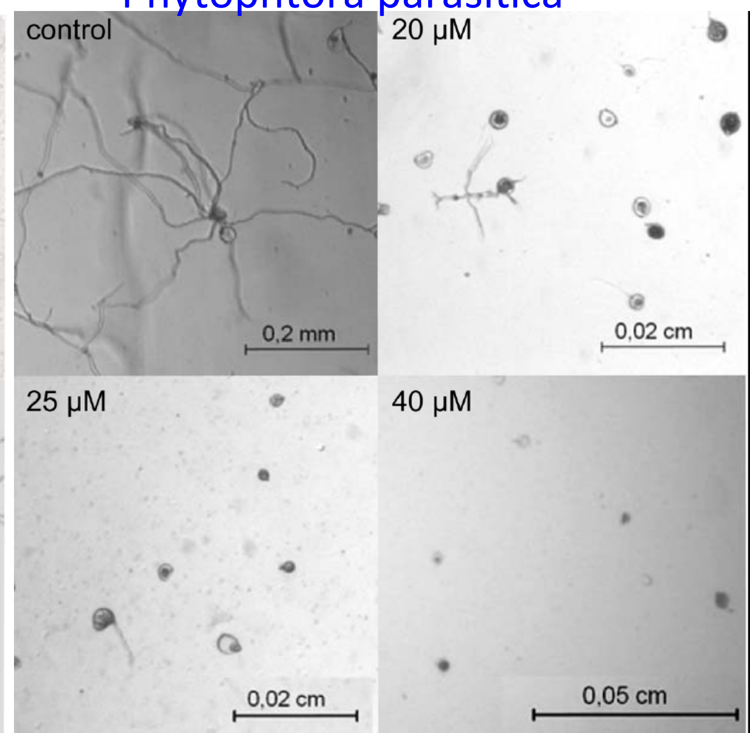
Pathogen	LSerFCP	MIC	IC_{50}
F. graminearum	synth.	5 µM	2,2 µM
	recomb.	2,5 µM	1,6 µM
P. parasitica	synth.	50 µM	35 µM
	recomb.	40 µM	29 µM

Anne Pöppel

Fusarium graminearum



Phytophtora parasitica



Knowledge-based screening

Target Identificati

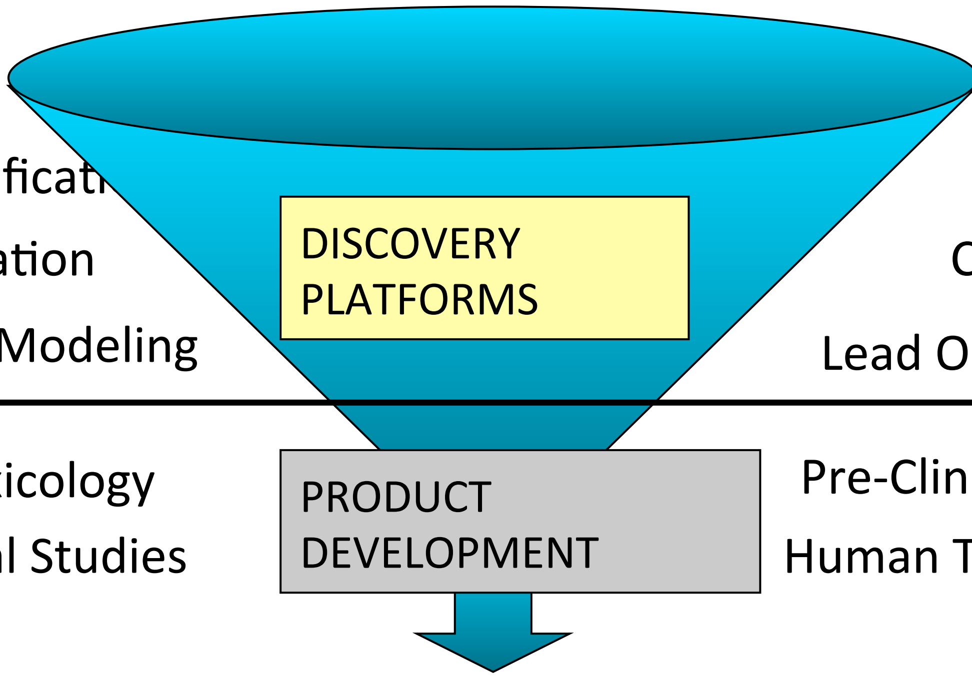
Target Validation

In Silico Modeling

Compound Screening

Computational Chemistry

Lead Optimization



Toxicology

Animal Studies

Pre-Clinical Development

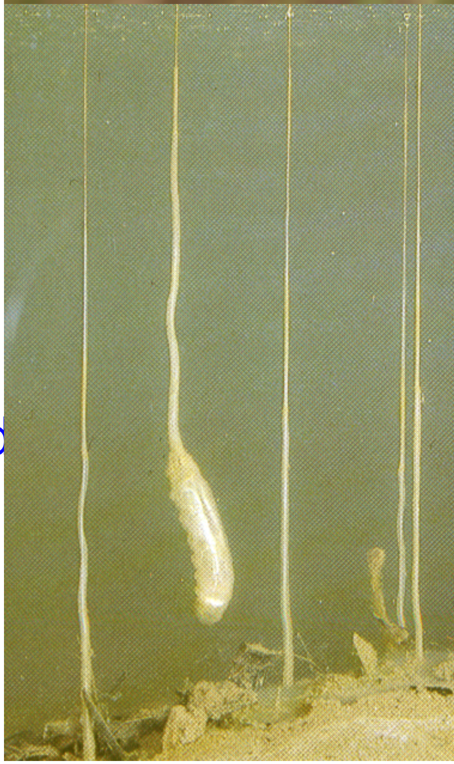
Human Trials

Knowledge-based screening

Environmental impact on insect immunity

The rat-tailed maggots of the drone fly *Eristalis tenax*

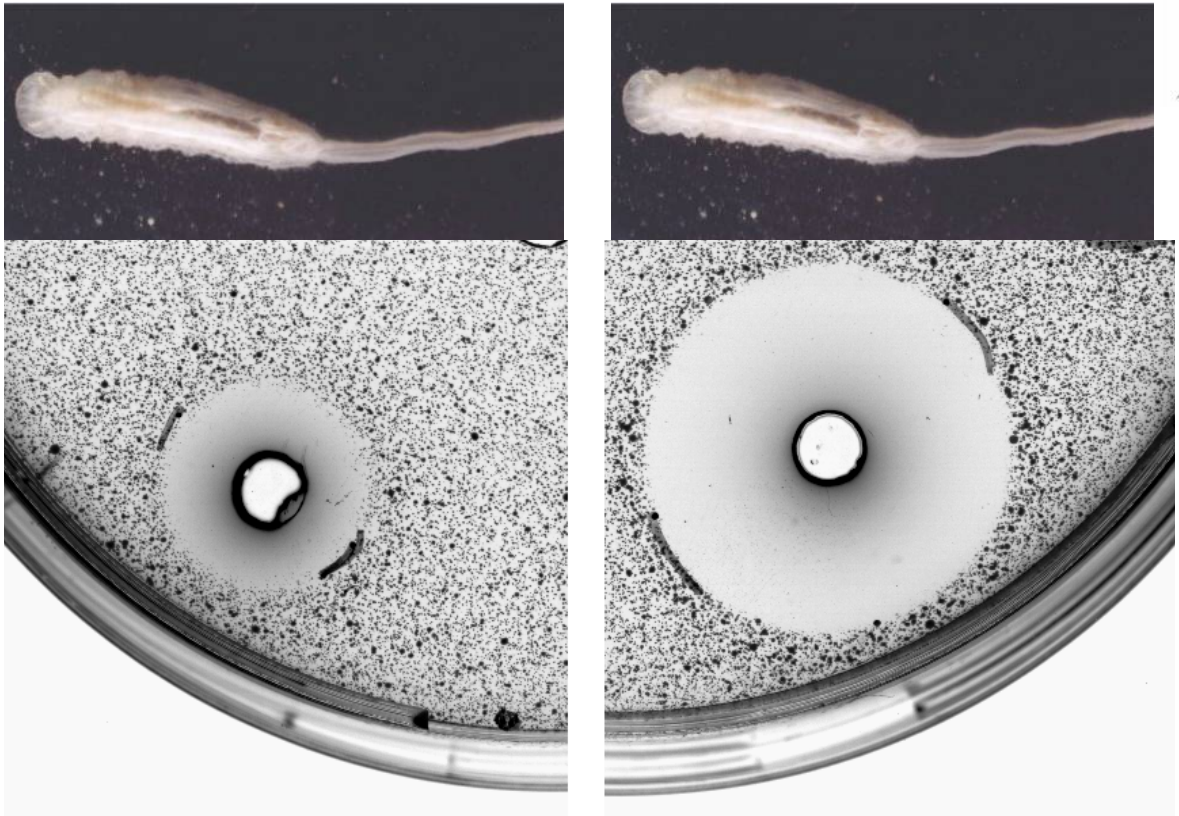
- Sapropahgous and coprophagous
- prominent resistance against microbial stress
- live in drains, cess pools, sewage pools and farmyard liquid manure storage pits lacking predators, parasitoids
- indicators for extremely high pollution with organic material in biological assessment of water quality
- Models to investigate trade-offs between fitness-costs and immunity



Altincicek & Vilcinskas 2008: BMC Genomics 8: 326

Environmental impact on insect immunity

1: Detection of high antimicrobial activity in the hemolymph of untreated larvae = standing army costs



2: …which increases remarkably upon injection of bacterial lipopolysaccharide = war costs

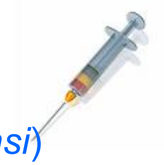
JUSTUS-LIEBIG-
UNIVERSITÄT
GIESSEN

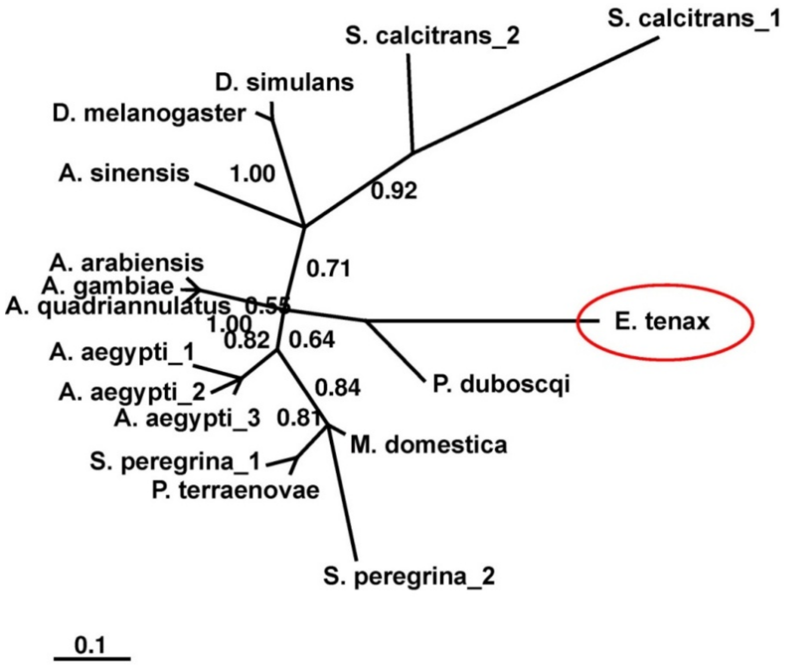
Altincicek & Vilcinskas 2008: BMC Genomics 8: 326

Fraunhofer
IME

Immune gene expansion and diversification

Et-AMP1	Defensin (*Phlebotomus duboscqi*)
Et-AMP2	Bactenecin-7 (*Bos taurus*)
Et-AMP3	Tachycitin (*Tachypleus tridentatus*)
Et-AMP4	Salivary protein SG3 (*Anopheles stephensi*)
Et-AMP5	a-helical cecropin-like peptide
Et-AMP6	Ser/Thr/Lys-rich putative disulfide bridged peptide
Et-AMP7	Putative disulfide bridged peptide with a pI 10,5
Et-AMP8	Putative disulfide bridged peptide with a pI 10,3
Et-AMP9	Putative disulfide bridged peptide
Et-AMP10	Putative disulfide bridged anionic
Et-AMP11	Glycine-rich peptide 1
Et-AMP12	Glycine-rich peptide 2
Et-AMP13	Glycine-rich peptide 3
Et-AMP14	Glycine-rich peptide 4
Et-AMP15	Linear peptide 1
Et-AMP16	Linear peptide 2
Et-AMP17	Linear peptide 3
Et-AMP18	Linear peptide 4
Et-AMP19	Linear peptide 5





ELSEVIER

Opinion

TRENDS in Ecology and Evolution Vol.19 No.10 October 2004

Full text provided by www.sciencedirect.com

SCIENCE DIRECT

A role for immunology in invasion biology

Kelly A. Lee[1] and Kirk C. Klasing[2]

[1]Department of Ecology and Evolutionary Biology, Princeton University, Princeton, NJ 08544, USA
[2]Department of Animal Science, University of California, Davis, CA 95616, USA

Hypothesis: strong humoral immune

responses should facilitate invasion

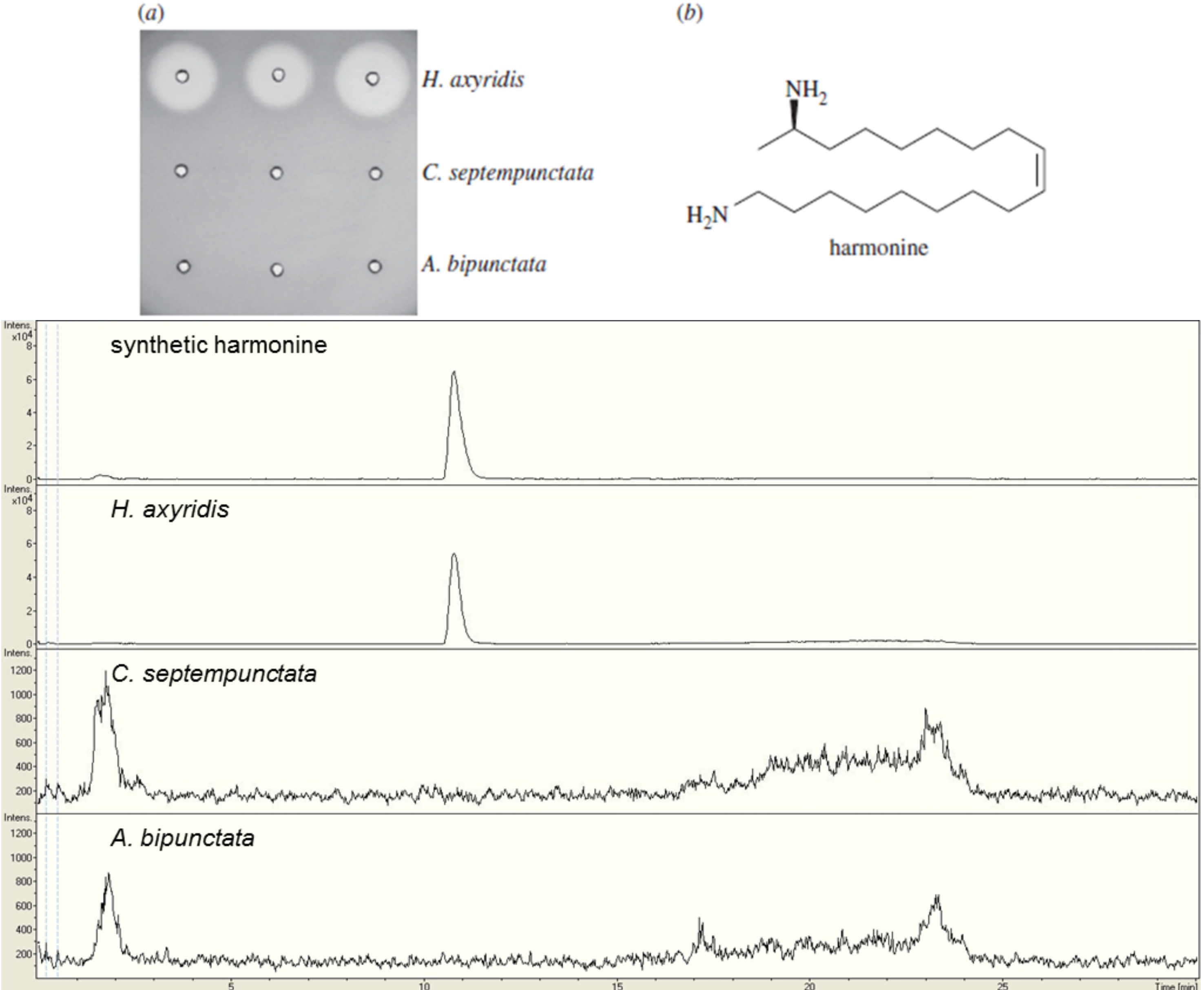
Antimicrobial Activity in the Hemolymph of Ladybirds

Adalia bipunctata
Native, Non-invasive

Coccinella septempuntata
Native, Invasive

Harmonia axyridis
Introduced, Invasive

Identification of Harmonine



Röhrich et al. 2012: Biology Letters 8, 308-311.

Harmonine exhibits broadspectrum antimicrobial activity

biology letters

Biol. Lett. (2012) 8, 308–311
doi:10.1098/rsbl.2011.0760
Published online 21 September 2011

Physiology

Harmonine, a defence compound from the harlequin ladybird, inhibits mycobacterial growth and demonstrates multi-stage antimalarial activity

Christian Rene Röhrich[1], Che Julius Ngwa[3], Jochen Wiesner[1,*], Henrike Schmidtberg[1], Thomas Degenkolb[2], Christian Kollewe[1], Rainer Fischer[1], Gabriele Pradel[3] and Andreas Vilcinskas[1]

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The harlequin ladybird beetle *Harmonia axyridis* has been introduced in many countries as a biological control agent, but has become an invasive species threatening the biodiversity of native ladybirds. Its invasive success has been attributed to its vigorous resistance against diverse pathogens. This study demonstrates that harmonine ((17*R*,9*Z*)-1,17-diaminooctadec-9-ene), which is present in *H. axyridis* haemolymph, displays broad-spectrum antimicrobial activity that includes human pathogens. Antibacterial activity is most pronounced against fast-growing mycobacteria and *Mycobacterium tuberculosis*, and the growth of both chloroquine-sensitive and -resistant *Plasmodium falciparum* strains is inhibited. Harmonine displays gametocytocidal activity, and inhibits the exflagellation of microgametocytes and zygote formation. In an *Anopheles stephensi* mosquito feeding model, harmonine displays transmission-blocking activity.

Keywords: *Harmonia axyridis*; insect immunity; harmonine; antimicrobial activity

1. INTRODUCTION

Harmonia axyridis, known as the Asian lady beetle or the harlequin ladybird, is a ladybird beetle native to two decades, *H. axyridis* has become an invasive species in many countries. In Europe, *H. axyridis* populations have been growing rapidly since the turn of the millennium, threatening populations of native ladybird species [1]. Its invasive success has been attributed to its enduring resistance against diverse pathogens, which allows it to outperform and therefore dominate the most abundant native European ladybirds, *Coccinella septempunctata* and *Adalia bipunctata* [2]. Besides antimicrobial peptides encoded by small genes and synthesized on ribosomes [3], many insects synthesize low-molecular mass defence compounds, or sequester such compounds from their diet. Ladybirds exude droplets of haemolymph containing deterrent alkaloids through their leg joints when threatened or attacked, a behaviour known as reflex bleeding [4]. In the present study, harmonine ((17*R*,9*Z*)-1,17-diaminooctadec-9-ene) was identified as the principal antimicrobial compound of *H. axyridis* haemolymph.

2. MATERIAL AND METHODS

(a) *Origin and rearing of ladybirds*

Adults of *H. axyridis* subsequently used for captive breeding were collected in and around Gießen and Ober-Mörlen, Germany. Adults of the seven-spot ladybird (*C. septempunctata*) and eggs of the two-spot ladybird (*A. bipunctata*) were obtained from Kath Biotech AG (Baruth, Germany). All ladybird species were reared in cages at 26°C and 60 per cent relative humidity under a 16 : 8 photoperiod. Bean plants (*Phaseolus vulgaris*) infested by pea aphids (*Acyrthosiphon pisum*) were provided as a food source.

(b) *Purification, structure determination and synthesis of harmonine*

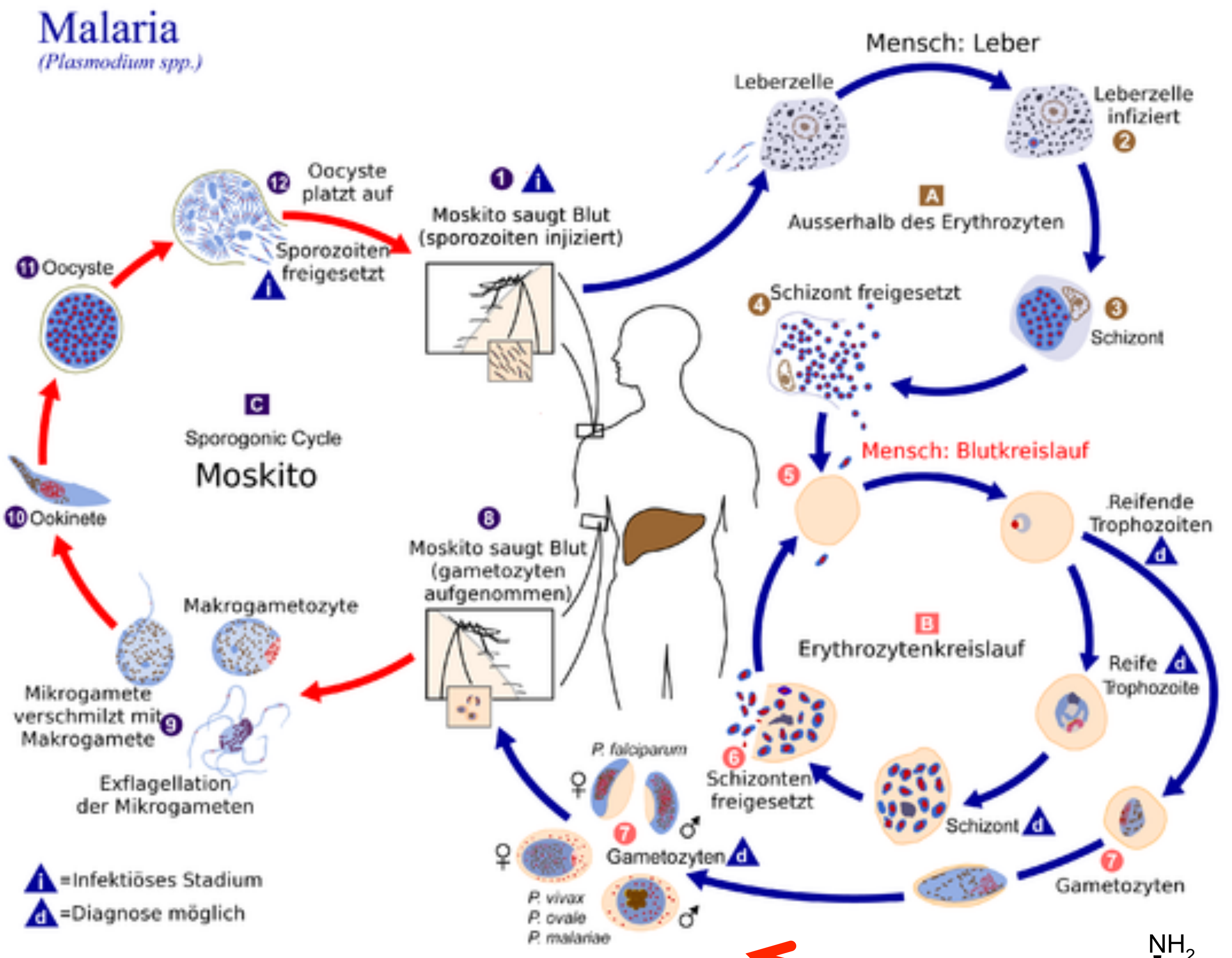
Haemolymph released by reflex bleeding was collected from 500 *H. axyridis* beetles. Groups of five beetles were vortexed for 10 s in 0.2 ml water in a 1.5 ml tube, and the combined liquid was heated to 95°C for 1 h and the precipitated material removed by centrifugation. The supernatant was supplemented with acetonitrile to a final concentration of 20 per cent (v/v) and passed over a strong anion exchange solid-phase extraction cartridge (ISOLUTE SAX 100 mg/3 ml, Biotage). The flow-through was loaded onto a strong cation exchange column (Mono S 5/50 GL, GE Healthcare) and eluted with a linear gradient of NaCl (0–1 M in water containing 20% acetonitrile). Fractions containing active compounds from the radial diffusion assay eluted at approximately 700 mM NaCl. After removal of excess acetonitrile by vacuum evaporation, final purification was achieved by chromatography on a reversed-phase column (Acclaim 120, C18, 3 µm, 4.6 × 150 mm; Dionex) by applying a gradient of 8–80% acetonitrile in water containing 0.1 per cent formic acid. The activity was recovered at approximately 45 per cent acetonitrile. Structure determination was performed on a micrOTOF-Q II mass spectrometer (Bruker Daltonics). Harmonine was synthesized following the protocol of Enders & Bartzen [5].

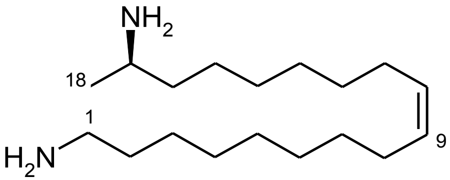
(c) *Antibacterial activity*

For radial diffusion assays, beetles were homogenized in 20 per cent acetonitrile (10 µl mg^{-1} beetle weight), and 5 µl of the supernatant was applied to yeast extract and tryptone agar test plates (well diameter 3 mm) containing *Escherichia coli* DE 31. Minimal inhibitory concentration (MIC) values were determined in triplicate with 1 : 2 serial dilutions. Activity against *Mycobacterium tuberculosis* was determined using the BACTEC MGIT 960 system (Becton Dickinson).

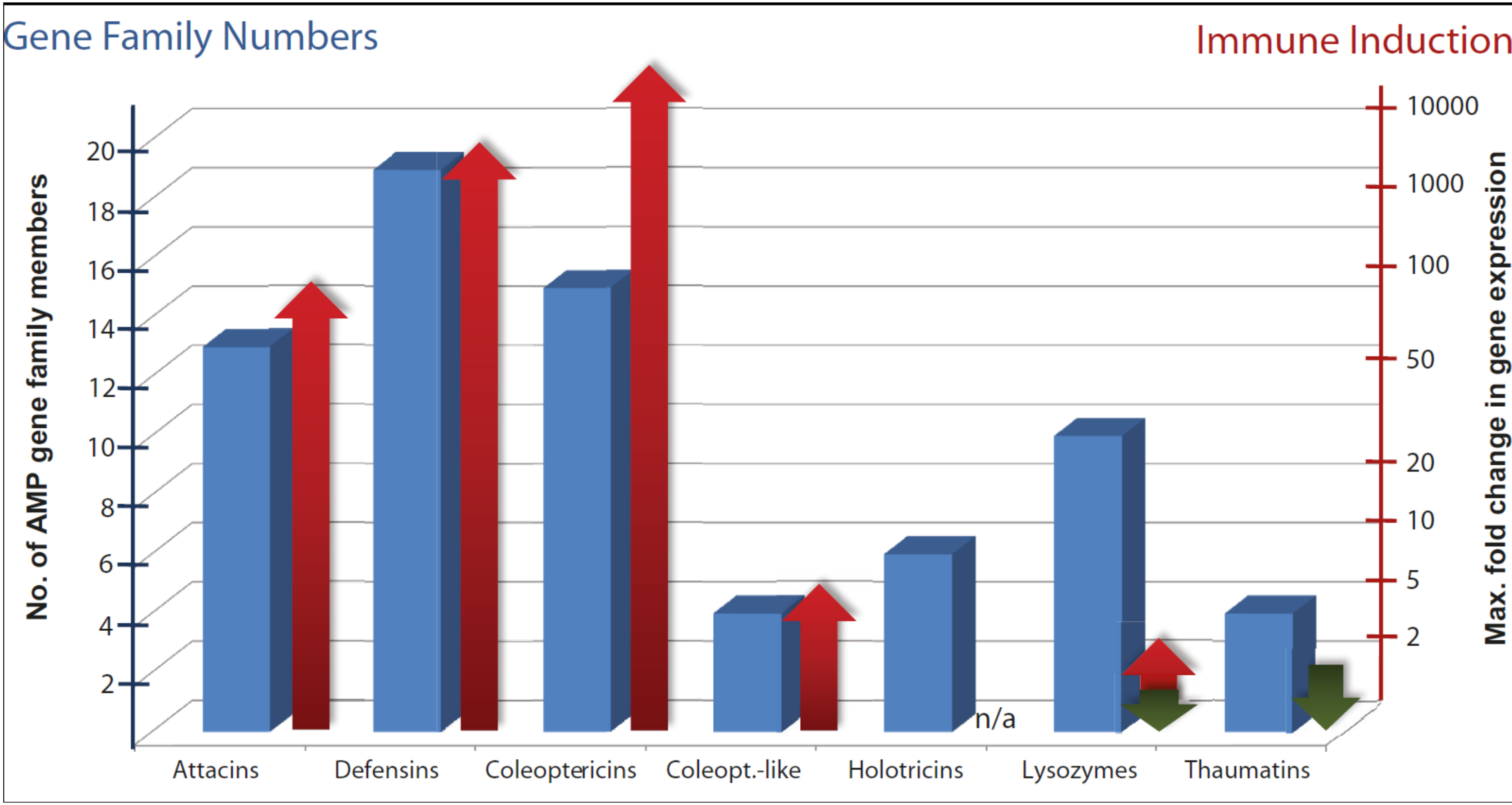
Röhrich et al. 2012: Biology Letters 8, 308-311.

Harmonine exhibits multistage anti-malaria-activity in vitro





Expansion of AMP genes in Harmonia axyridis



Vilcinskas et al. 2013: Proceedings of the Royal Society B, 280

Insect-derived anti-infectives

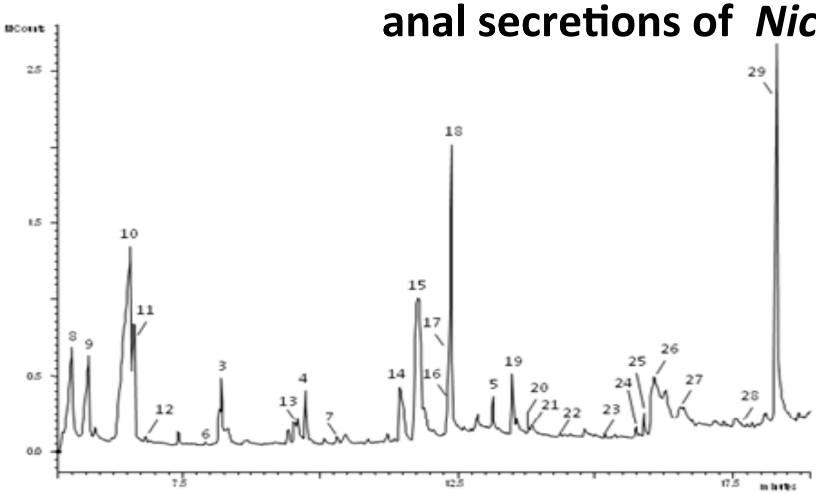
Burrying beetle *Nicrophorus vespilloides*

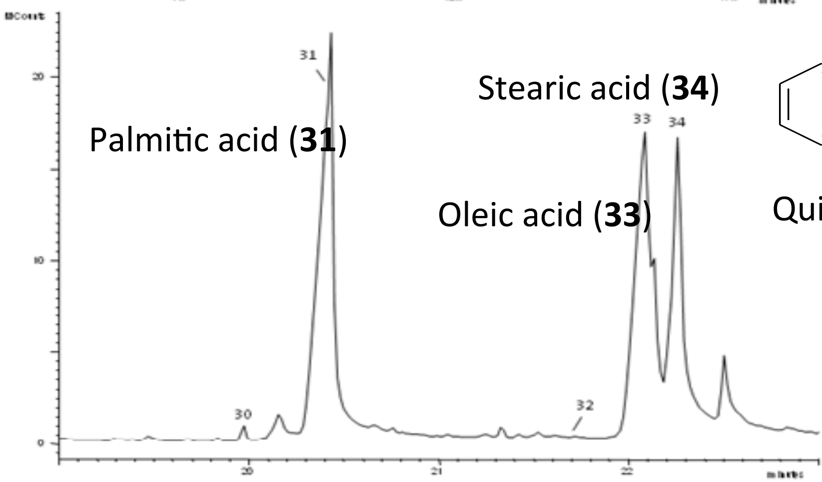
- burries small carcasses into the soil upon localization by emited volatiles
- chemically preserves cadavers from microbial decay
- preoral digestion to prepare carcasses as a diet for their offspring

Degenkolb , Düring, Vilcinskas 2011: Journal of Chemical Ecology 37, 724-735

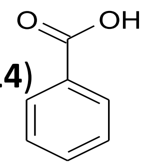
Insect-derived anti-infectives

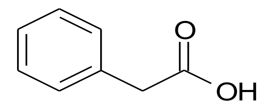
Examples of antimicrobials and other metabolites detected in anal secretions of *Nicrophorus vespilloides*



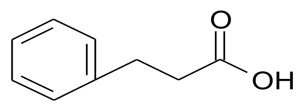


Benzoic acid (**14**)

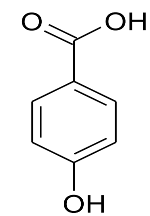




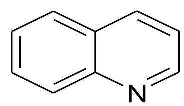
Phenylacetic acid (**17**)



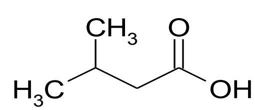
Phenylpropionic acid (**19**)



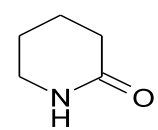
p-Hydroxybenzoic acid (**26**)



Quinoline(**18**)

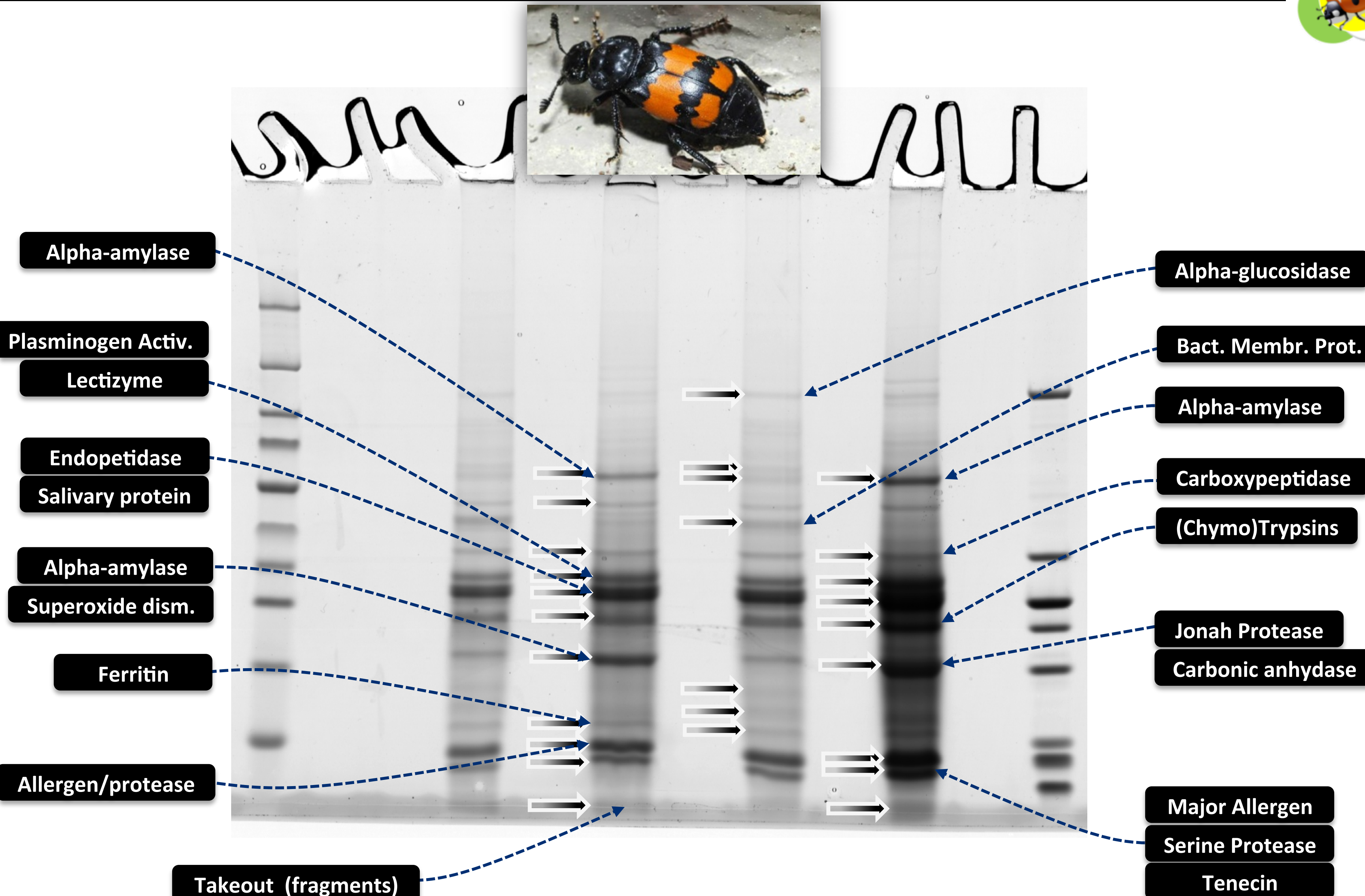


Isovaleric acid (**10**)



δ-valerolactam (**15**)

The burrying beetle as a source for industria l enzymes



Insect-derived enzymes in white biotechnology

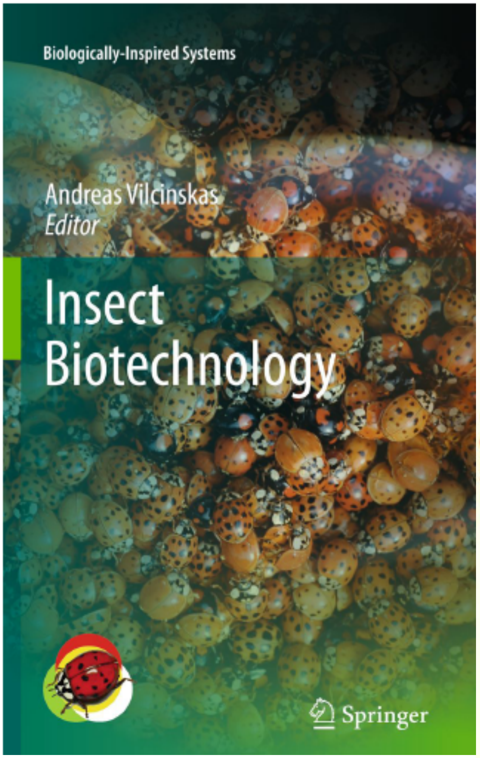
Clothing moth *Tineola bisselliella*

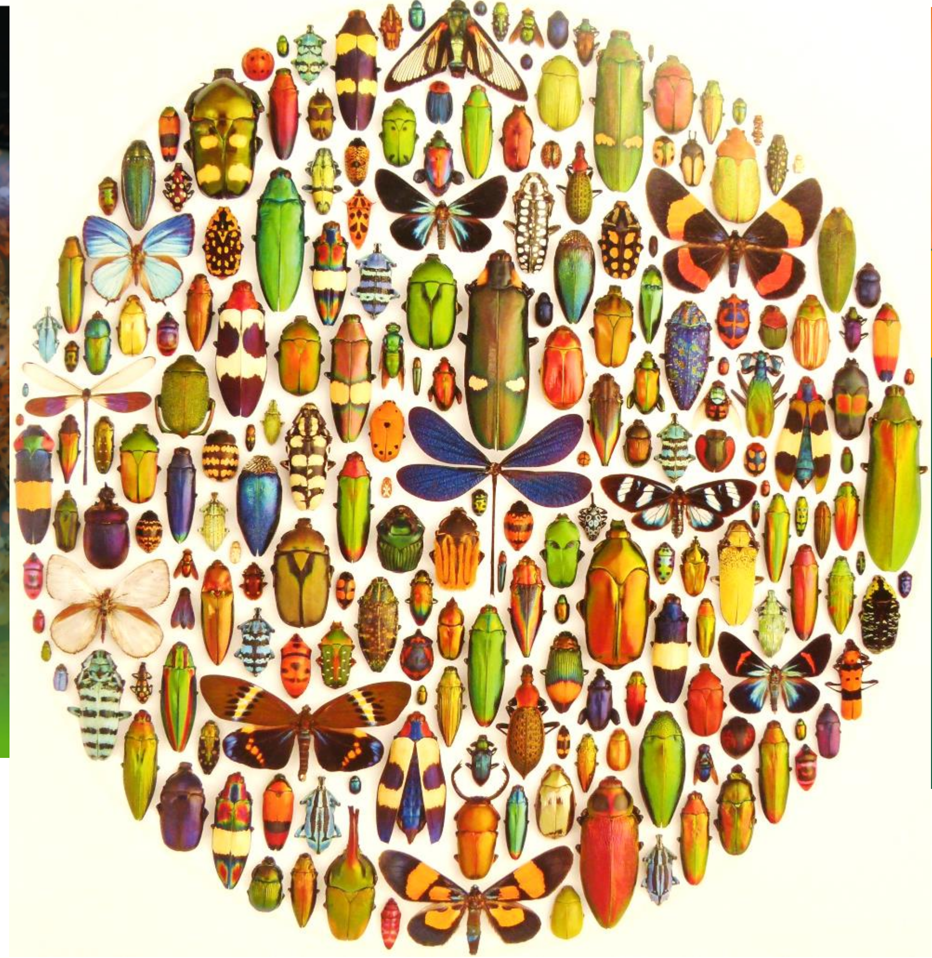
- Feeds on clothing and natural fibers including cotton, linen, silk, wool
- Turns keratin into food
- Source for industrial enzymes
- NextGenSeq of the gut transcriptome
- FISH-based analysis of gut microbiota
- To be developed for industrial fermentation of clothing and natural fibers

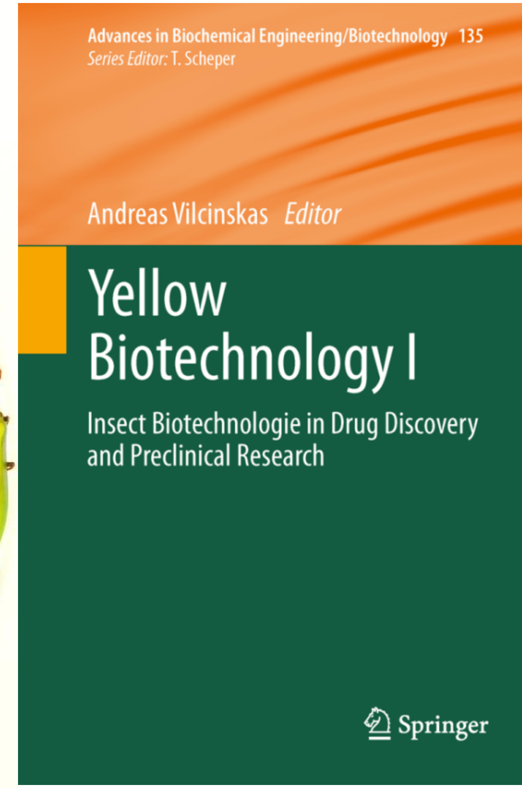
Thanks to the members of the
LOEWE-center for Insect Biotechnology

Thank your for your attention

http://insekten-biotechnologie.de/en/start.html







Insects as a resource for medicine, plant protection and biotechnology

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JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

Fraunhofer IME

GLOBAL BIOECONOMY SUMMIT 2015

Bioeconomy, Biodiversity, Climate

Maria Beatriz Martins Costa

CEO Planeta Orgânico

November 26th, 2015
Berlin

GREEN RIO

Rio Orgânico

In 2012, in the same period of UN event Rio+20, the first edition of Green Rio / Rio Orgânico was held at the Convention Center of Rio Stock Exchange. Green Rio 2012 was recognized by the Government of the State of Rio de Janeiro as a Rio+20 side event.

Since 2012, the Green Rio event offers a marketplace for sustainable and organic players. Participants in Green Rio include government representatives, investors, responsible consumers, opinion formers in the spheres of gastronomy, tourism and retail.

More than 100 meetings were held in the Business Round of Green Rio 2015, that took place at Espaço Tom Jobim, in the Botanic Garden of Rio de Janeiro

The Botanical Garden of Rio de Janeiro's mission is to promote, conduct and disseminate scientific research, with an emphasis on flora, aimed at the conservation and valuation of biodiversity and carry out activities promoting the integration of science, education, culture and nature.

JARDIM BOTÂNICO DO RIO DE JANEIRO

museu do meio ambiente

The Museum of Environment is the first in Latin America entirely dedicated to the socio-environmental theme, the Museum of the Environment is a pioneer space of exhibitions, educational programs and debates focused on active participation and joint construction of knowledge society.

The sustainable use of biodiversity and ecosystem services is not only the key to economic development, but is also of vital importance to human development, if used wisely.

CEAL
Consejo Empresarial de América Latina

CEAL is regarded as the voice of the Latinamerican entrepreneurs.
In the CEAL Summit in Rio de Janeiro, October 2015, CEAL's border has decided to include Bioeconomy in their priority goals,

Brazil shelters 15 to 20 % of global biodiversity, disposes of the greatest number of endemic species and is one of the most important mega-diverse countries in the world.

The Brazilian biodiversity - the world's largest - is a strong asset in the setting of the global Bioeconomy

Seven Brazilian States are involved in the Structuring Project for Amazon Forest-Based Cosmetics: Acre, Amapá, Amazonas, Pará, Roraima, Rondonia and Tocantins.

AMAZON
forest-based
COSMETICS

SEBRAE

The Amazon IEA Rainforest Business School Project

For professionalization in sustainable rainforest business

Maritta Koch-Weser amazoniea@usp.br

[redacted]

GREEN RIO

Rio Orgânico

Bioeconomy & Biodiversity will be one of the Green Rio 2016 highlights

www.greenrio.com.br

2A2 Marketing & Eventos

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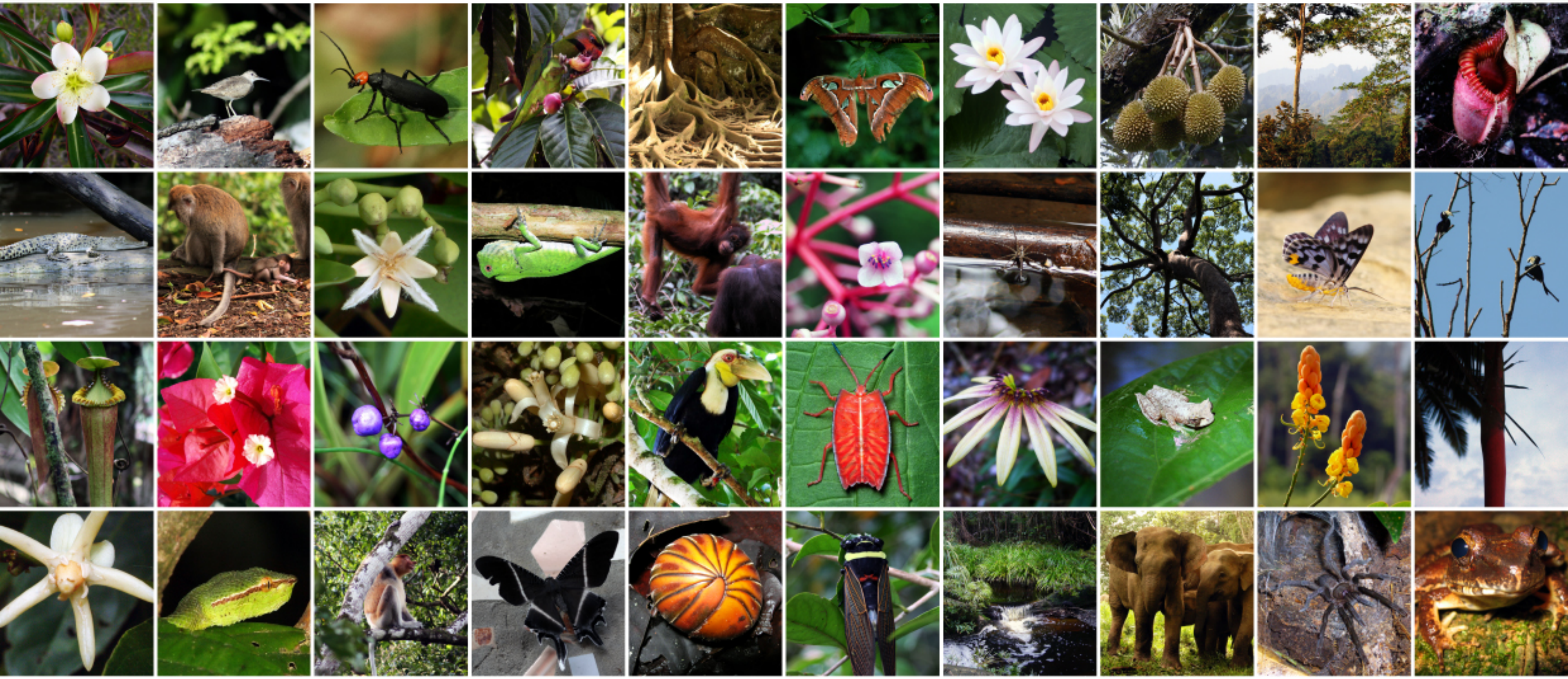
Indonesian Biodiversity Discovery and Information System (IndoBioSys)



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Thomas von Rintelen, Christoph Häuser, Rosichon Ubaidillah

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Indonesian Biodiversity Discovery and Information System

Biodiversity → **Bioeconomy**

Aim

Provide the foundation for knowledge-based **biomedical discovery in Indonesia**

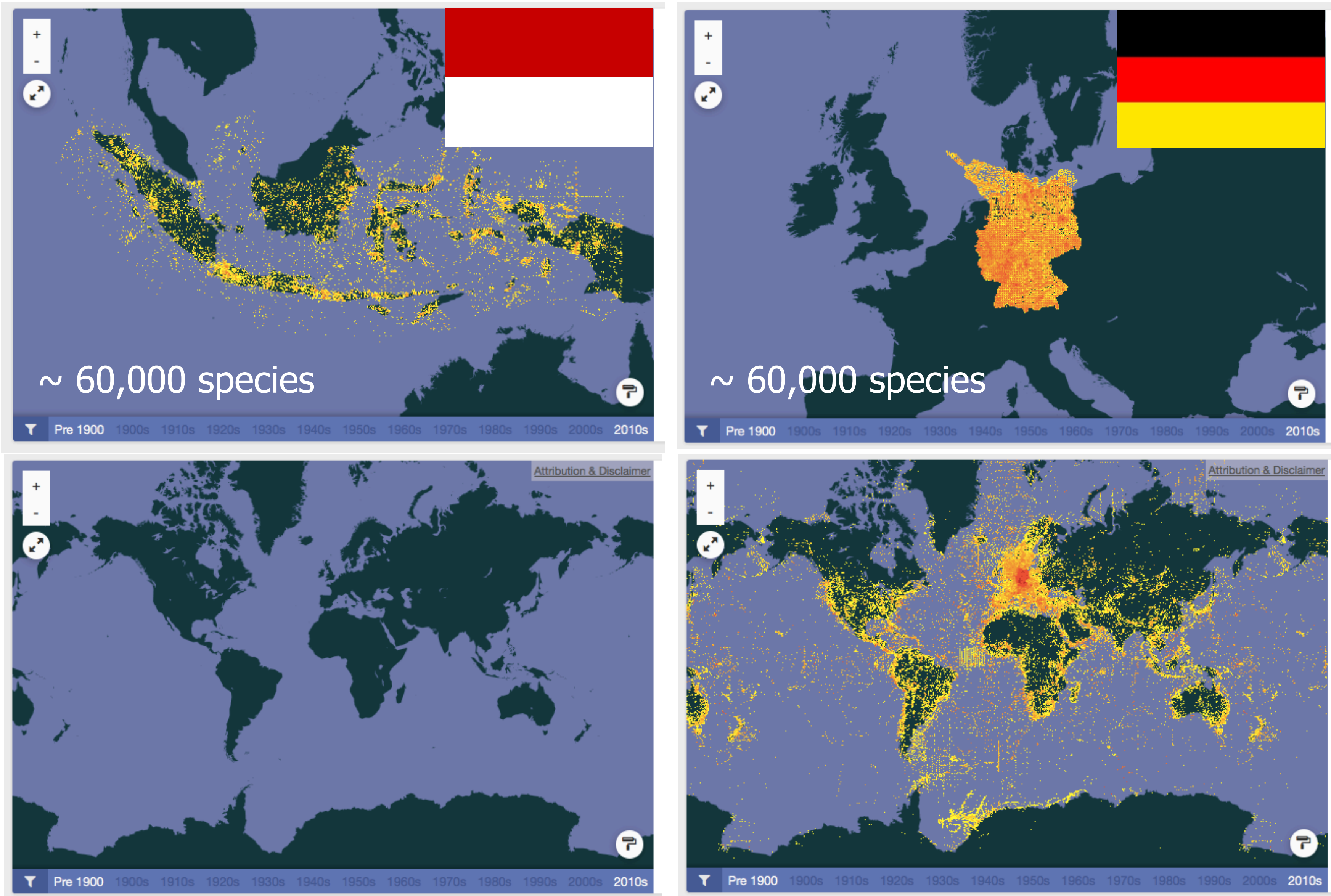
Indonesia - biodiversity ‚facts':

- Rank 3 of most biodiverse countries
- >10% of the world's rainforests
- country with most mammal species (530)
- more than 37,000 plant species

50-90% of Indonesian species are not known

➢ **Vast underexplored resource for natural compounds (e.g., anti-infectives)**

Global Biodiversity Information Facility:



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exploration
collections
existing
knowle ge
sample/specimen
processing
automated image
& pattern analysis
industrial screening
(DNA, biochemistry, etc.)
au mated characterization
& identification
feed web da bases
application
ASPIRIN
application
semi-automated morphological
description and imaging
rapid publication
TAXONOMIST DAILY
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Indonesian Biodiversity Discovery and Information System

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Indonesian Biodiversity Discovery and Information System

Biodiversity → Bioeconomy

Aim

Provide the foundation for knowledge-based **biomedical discovery in Indonesia**

Approach

1. Novel and fast ***biodiversity discovery pipeline*** for underexplored high biodiversity areas and

2. ***Indonesian biodiversity information*** system for providing biodiversity information to stakeholders from Science, Industry, Society

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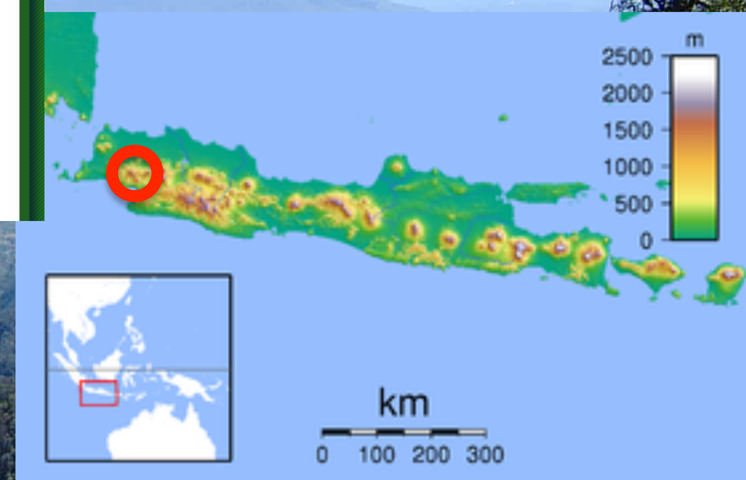
IndoBioSys – Discovery and Information

Mount Halimun-Salak NP



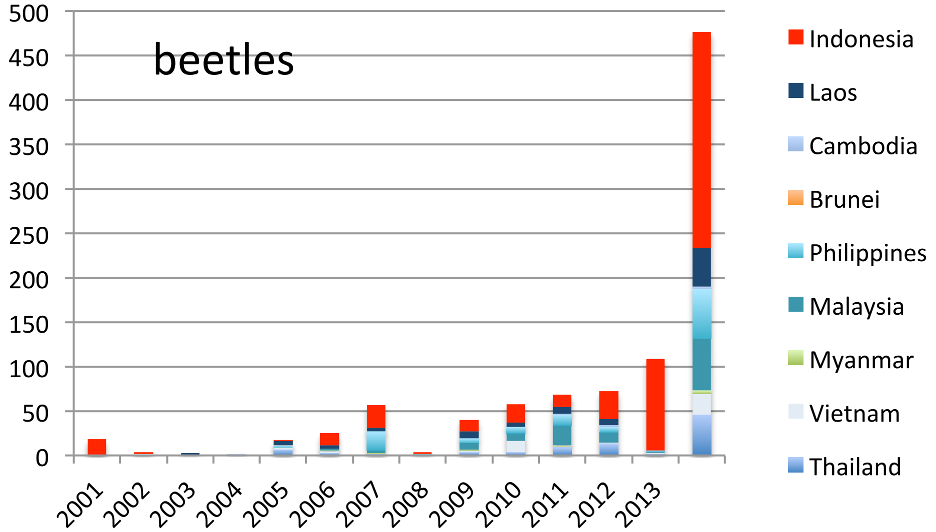
IndoBioSys – Discovery and Information

Mount Halimun-Salak NP

Involvement of stakeholders

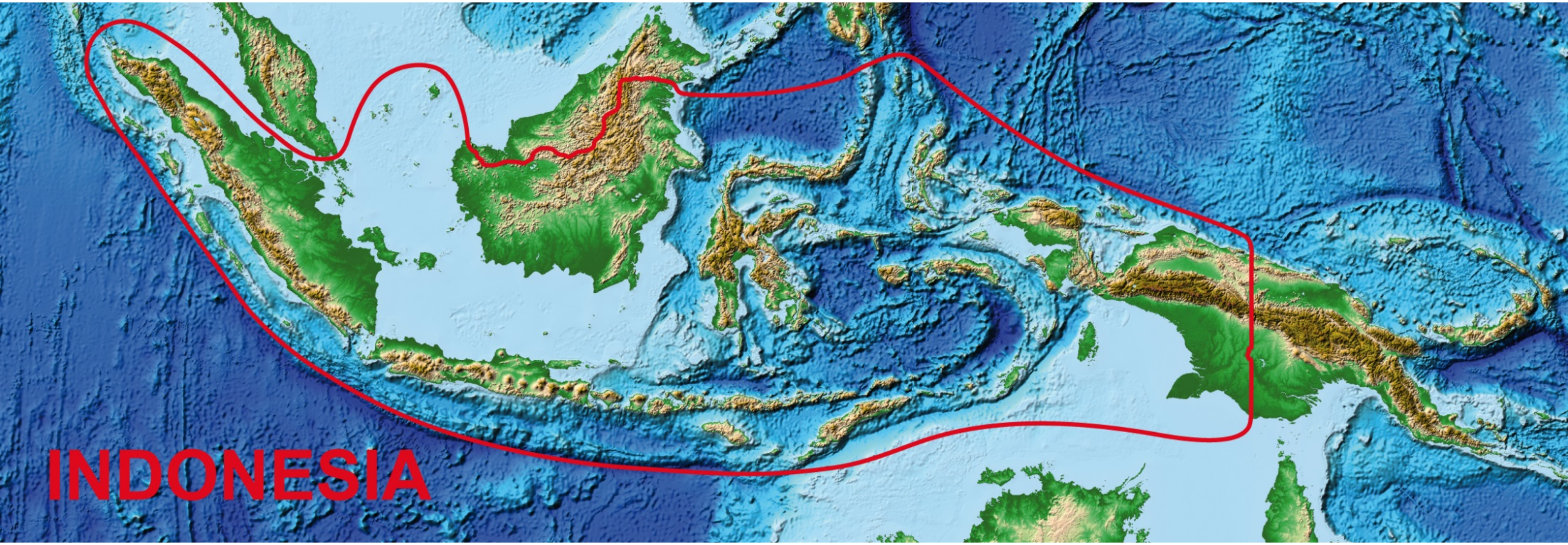
- What data?
- Feedback Loop

➢ **A global resource**



Only 9 % of publications describing new species from Indonesia have an Indonesian (co)author

Only 50 % of publications describing new species from Indonesia are freely available



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