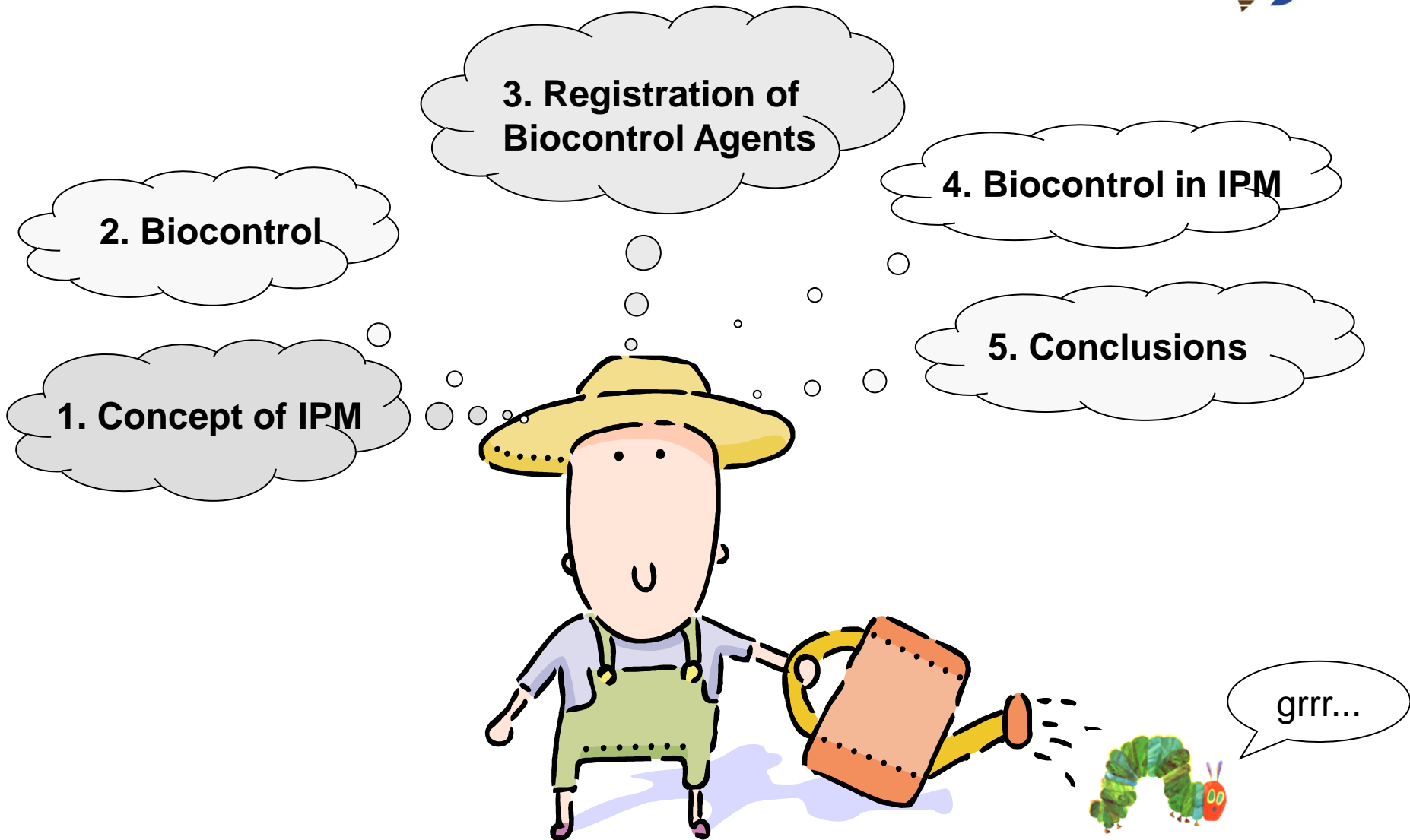


The Diversity of „Biorationals“ – learning from Biocontrol Agents

Johannes Jehle

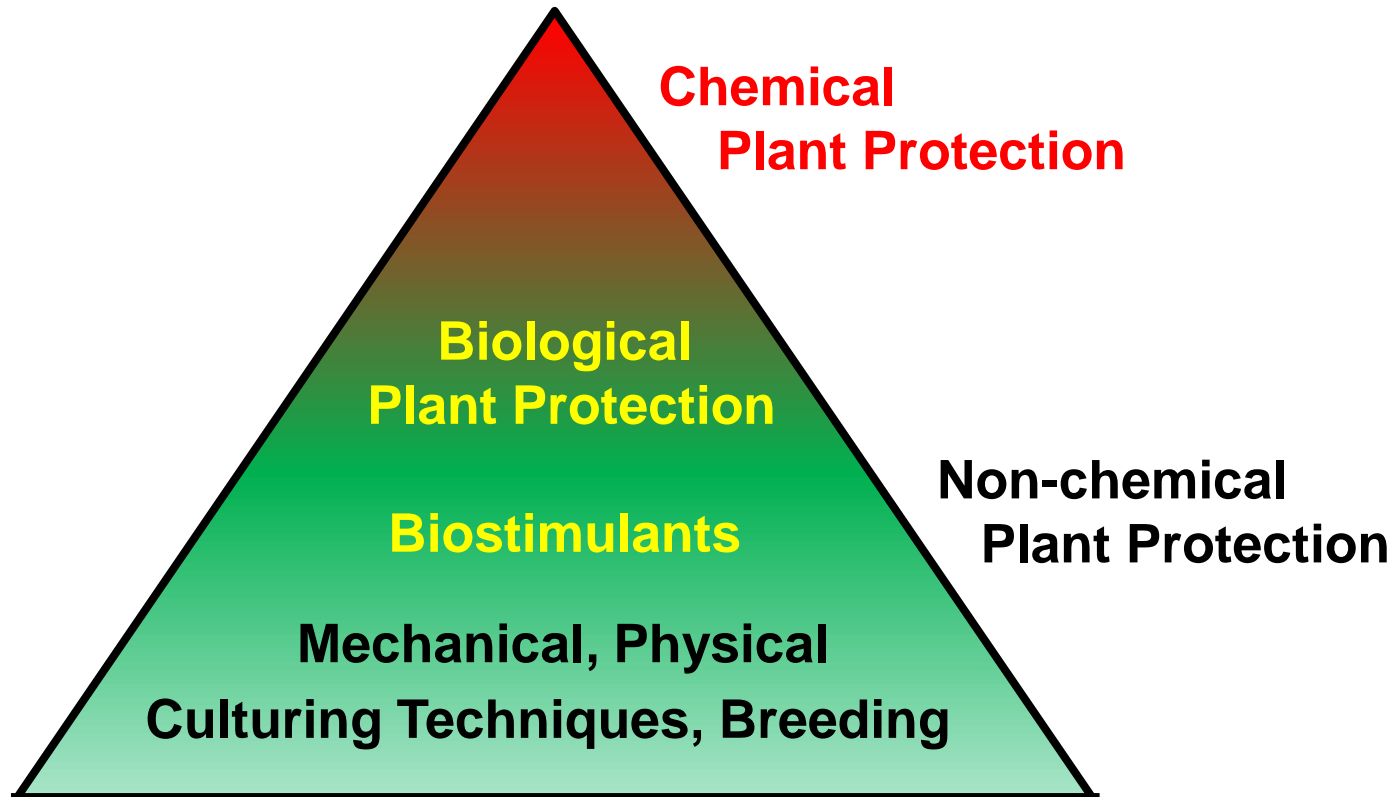
Julius Kühn-Institut, Darmstadt, Germany

NAP-Forum 13./14.12.2017 Braunschweig



The Concept of IPM

Fire Brigade = Intervention



Fire Safety = Prevention

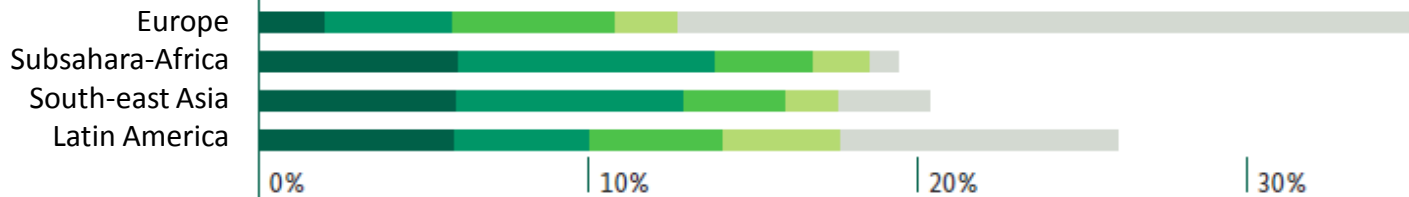
Neglect of Fire Safety in Plant Protection

- Application of IPM is mandatory in Europe since 2014:
Directive 2009/128/EC
- Despite 30 years of IPM in German Plant Protection Law: Plant protection mainly based on chemicals
 - Unintended non-target effects
 - Residues and (unrealistic) consumer expectations
 - Rapid development of resistance
- „Disease spread is like a forest fire“: because of lack of fire safety
- 90-98 % of sprays do not reach target: Damage caused by fire fighting
- Decline of biodiversity: Agricultural intensification is also the consequence of low prizes and food waste

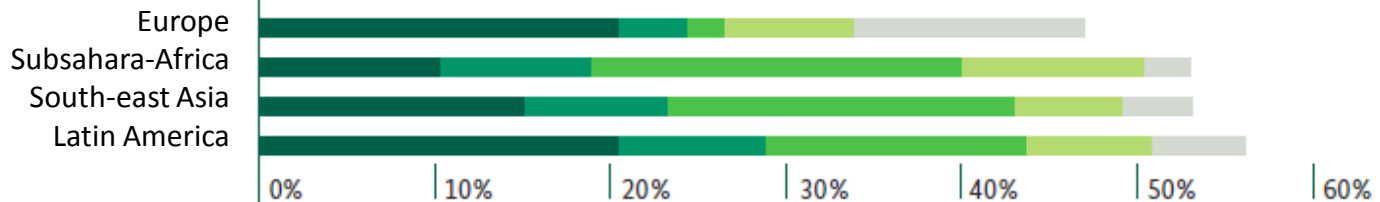
Loss of Foodstuff



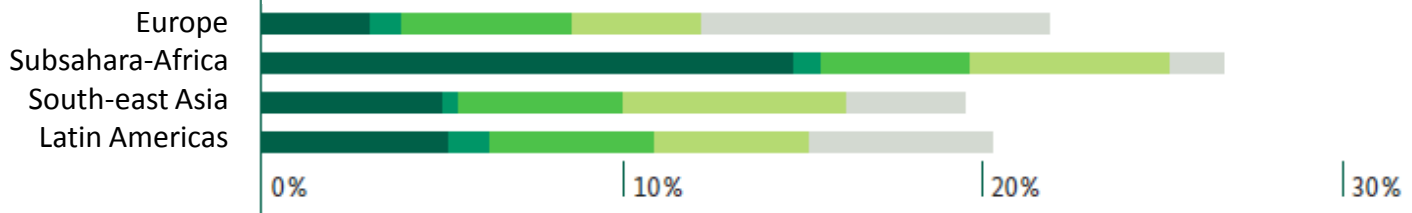
Cereals: 30% loss worldwide



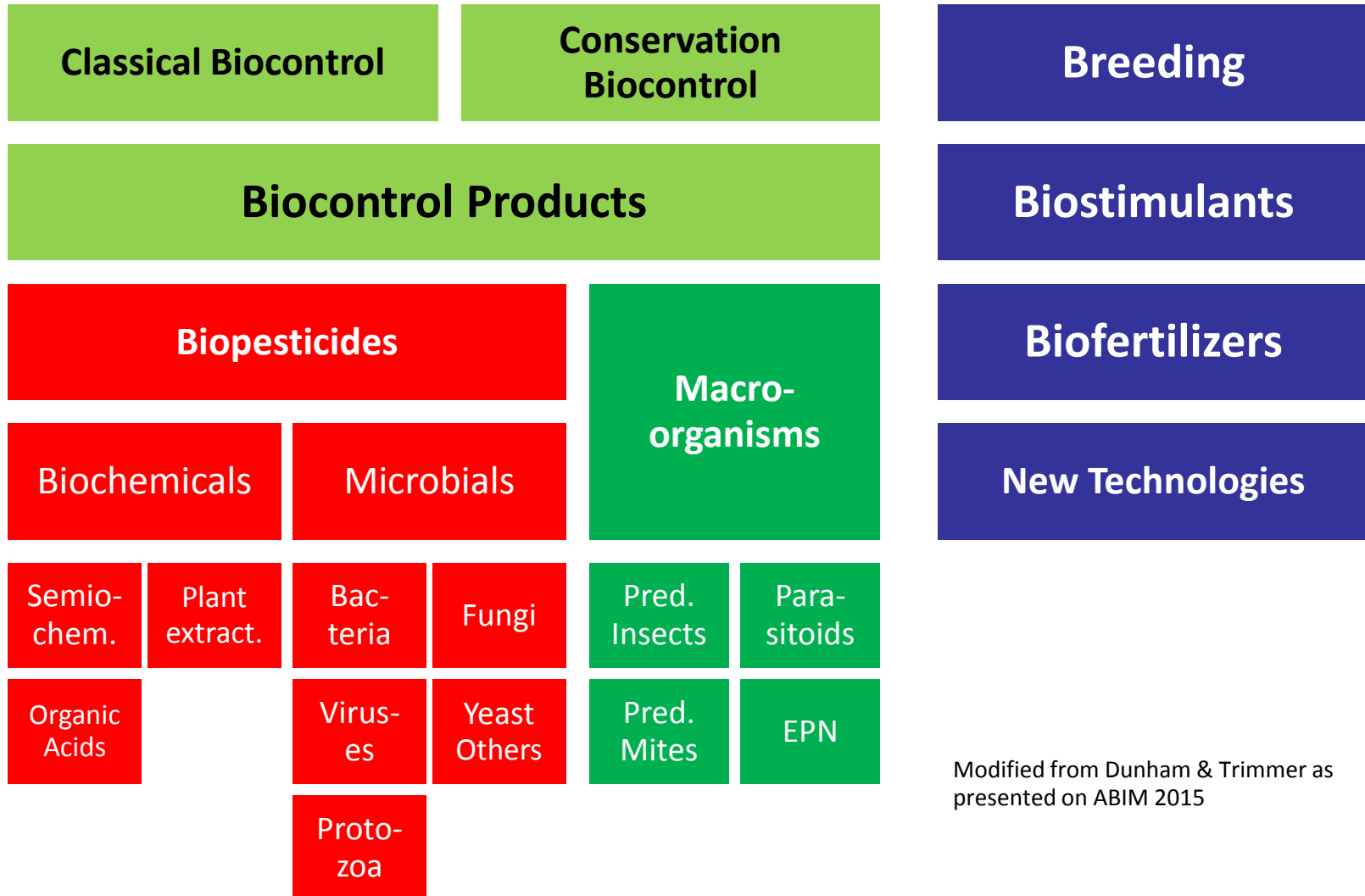
Fruits: 45% loss worldwide



Meat: 20% loss worldwide



The Bounty of Biological Tools



Modified from Dunham & Trimmer as presented on ABIM 2015

The Registration Process of Microbial Biological Control Agents (MBCAs)

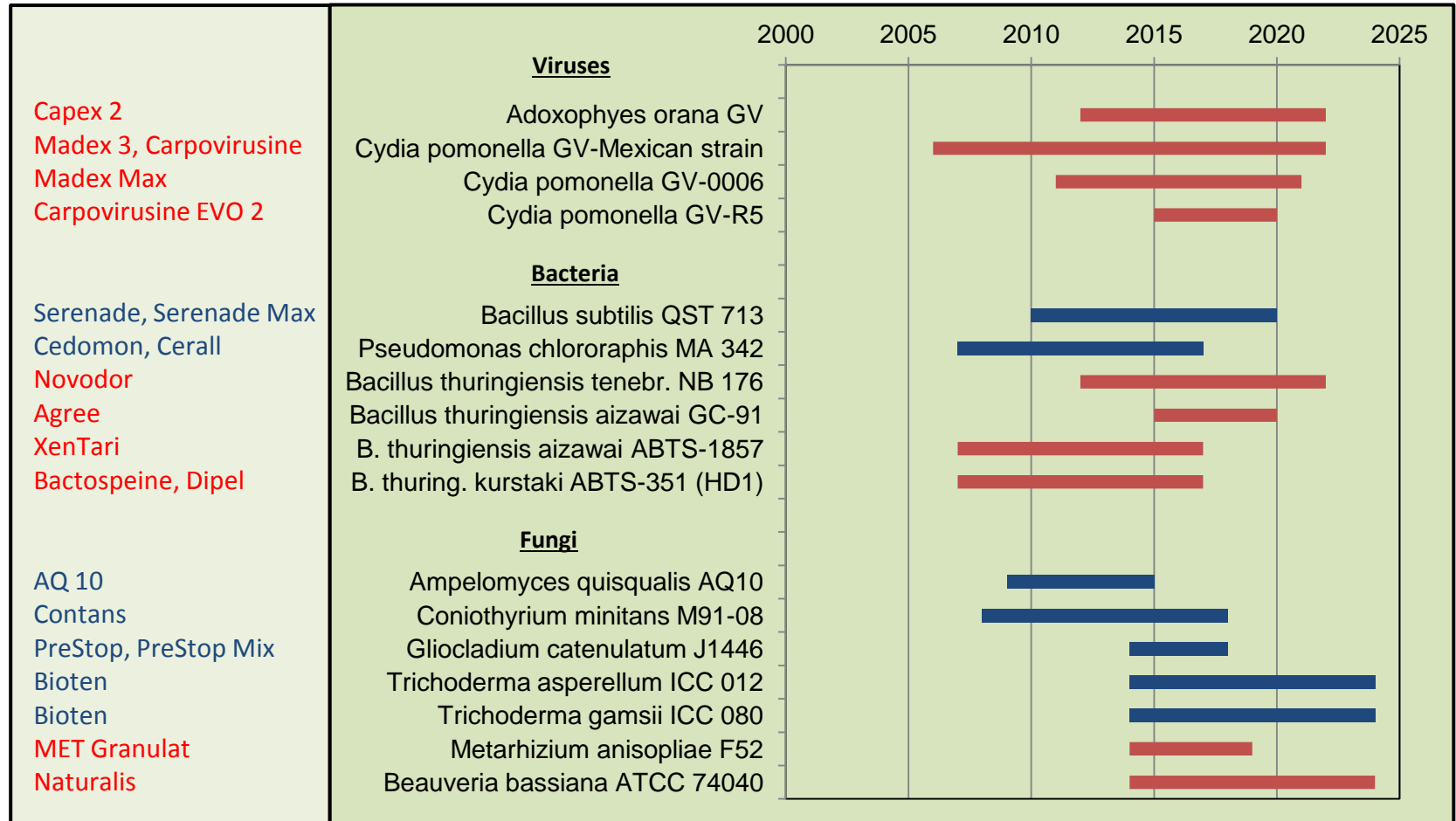


Before 1993 in the national responsibility	<ul style="list-style-type: none">• Many national registration• Individual registration in each country• No common legal frame work
1993 – 2011 Directive 91/414/EC	<ul style="list-style-type: none">• uniform rules on the evaluation, authorisation, placing on the market• control of plant protection products and the active substances they contain
Since 2011 Regulation (EC) No. 1109/2009	<ul style="list-style-type: none">• Harmonization of plant protection registration• Reduce risk for human and animal health• Reduce risk for environment• Safeguarding the competitiveness of European Agriculture

414/91 based harmonization caused loss of MBCAs

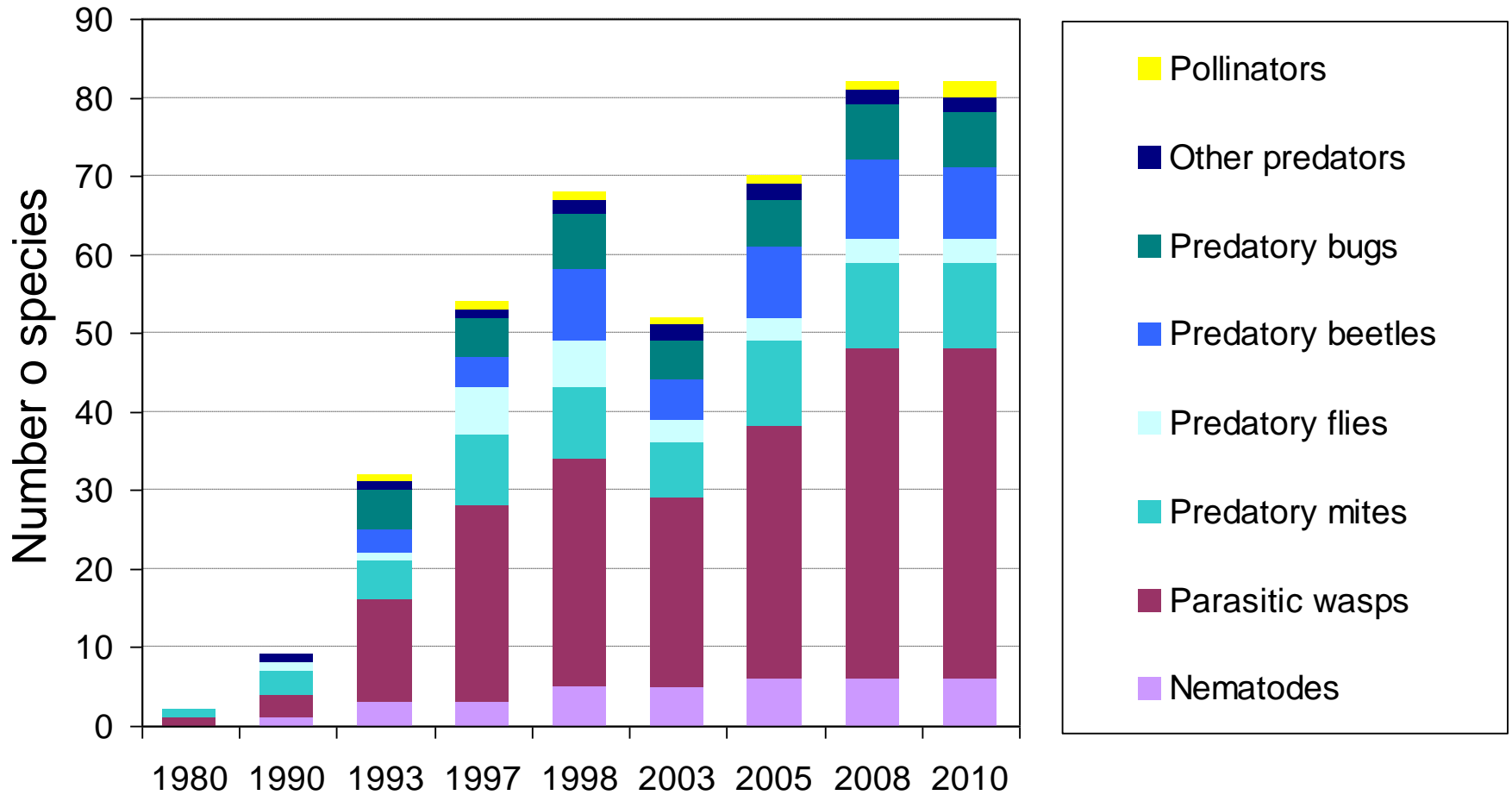
- **Pre-91/414:** 22 species of micro-organisms in Europe registered
- **91/414 Transition:** only 16 MOs defended as pre-existing, **thereof 8 Entomopathogens**
6 MOs got lost (e.g. *Beauveria brongniartii*, three baculoviruses and others)
- **91/414:** Initially only 8 MBCAs included into Annex I, several were pending for seven and more years

Registered Microbial Biocontrol Agents in Germany



■ Disease control
■ Insect control

Commercial Beneficials in Germany



Release area of Beneficials (ha/year)

Most important commercially available beneficials:

Beneficial species	1993	1996	2001	2009	2010	Crop	Target pests
<i>Trichogramma brassicae</i>	5900	5600	9443	19414	22484	Corn	<i>Ostrinia</i>
<i>Encarsia formosa</i>	196	403	273	198	1266	Veg & Orn	White fly
<i>Aphidius - species</i>	65	174	174	203	1042	Veg & Orn	aphids
<i>Lysiphlebus testaceipes</i>		0.5	7.8	20	315	Veg & Orn	aphids
<i>Diglyphus isaea</i>	19	73	95	27	119	Veg & Orn	Leaf miners
<i>Aphidoletes aphidimyza</i>	66	131	134	54	48	Veg & Orn	aphids
<i>Chrysoperla carnea</i>	10	55	40	4	62	Veg & Orn	aphids & more
<i>Phytoseiulus persimilis</i>	123	125	126	85	332	Veg & Orn	spider mites
<i>Amblyseius sp.</i>	104	174	201	25	1470	Veg & Orn	mites & thrips
<i>Entomopath. Nematodes</i>	47	413	200	1272	247	Veg & Orn	various

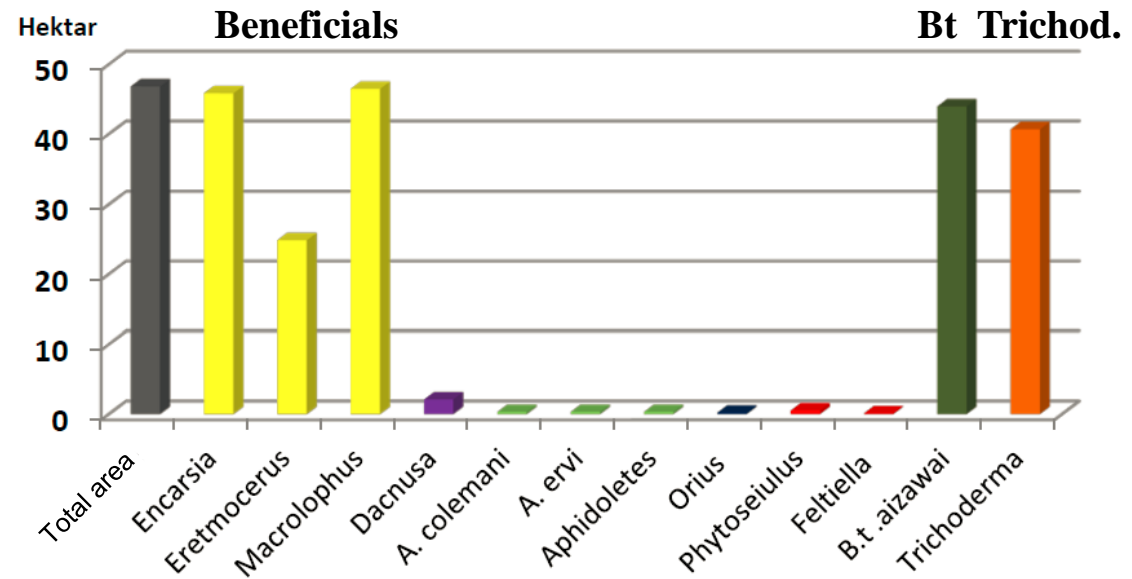
IPM is a System!

- ✓ Multic-component system by definition!
- ✓ Components are not inter-changeable!
- ✓ Components need to work together!
- ✓ Prevention should prevail intervention!
- ✓ Systemic approach of differently efficacious tools!
- ✓ Clear development: Fewer chemicals a.i. will be available!

An Example from Practice



Tomato in Greenhouse

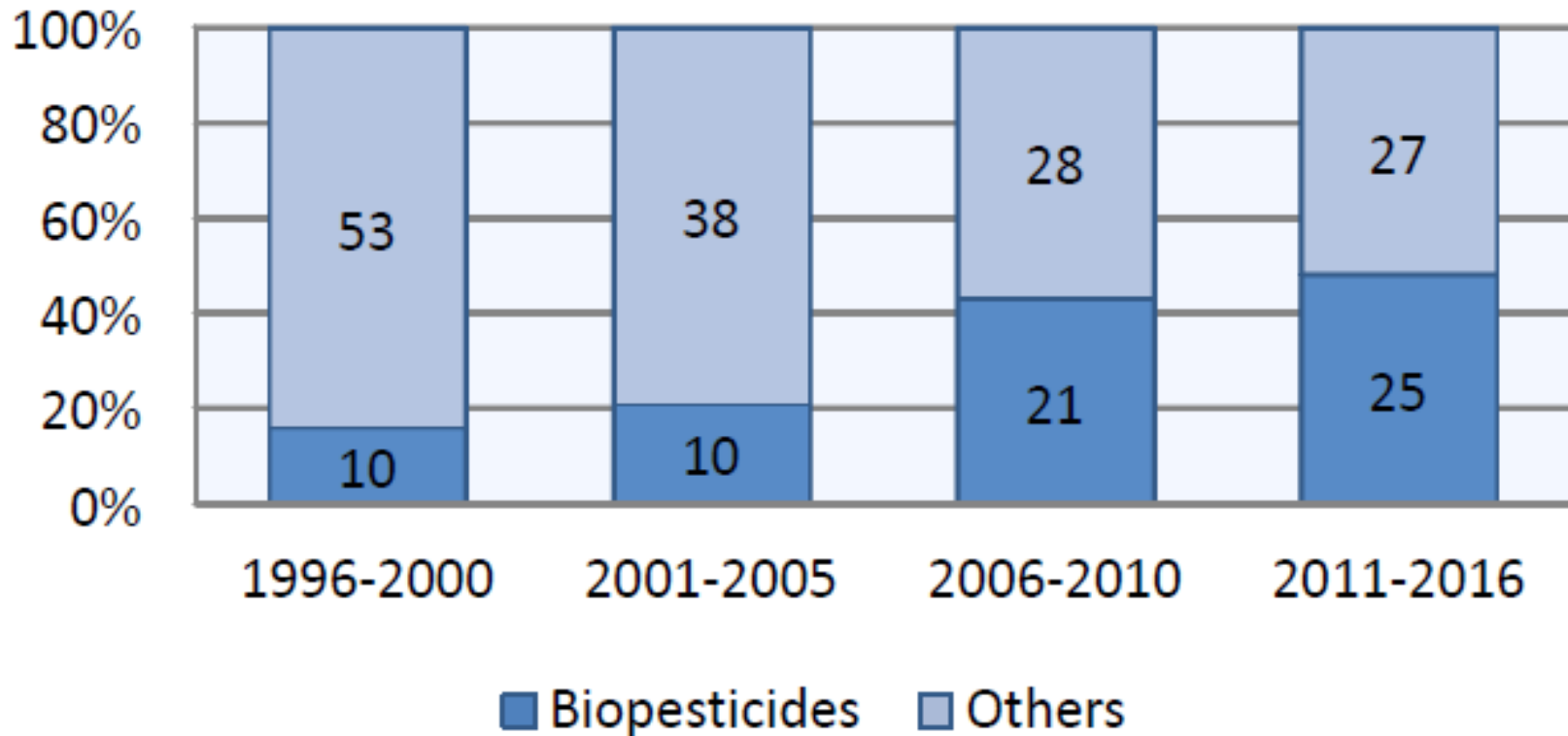


Tomato in Greenhouse in Niederrhein area:

- Control of insect pests only with biocontrol
- Use on ~98% of growing area

Source: LWK NW, Heike Scholz-Döbelin
Statusbericht Biolog. Pflanzenschutz 2013

Application of new Active Substances since 1996



Source: EU Comm. 2016

What are the consequences?

- ✓ Biological Control Agents
 - *are highly specific,*
 - *have a narrow application segment,*
 - *application profile have an **intrinsic reduced risk***

- ✓ „Replacing“ a single chemical a.i. will require many biologicals
 - *Registration of biological a.i. is strain-specific:*
Different strains have similar properties!

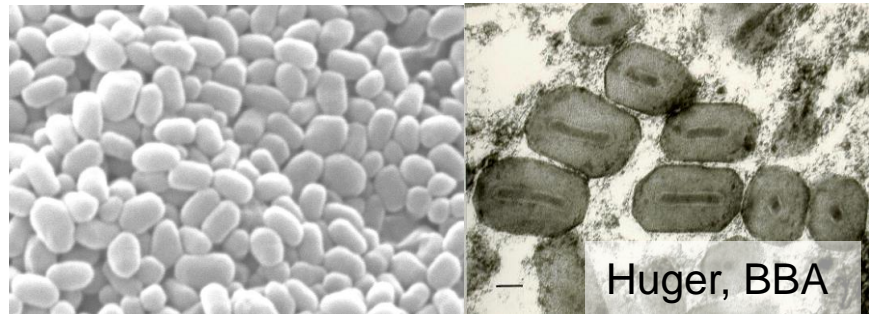
- ✓ Many potential biologicals not registered because of high registration costs compared to market volume (no ROI)

- ✓ Increasing gap of indications will require new approaches in the registration of biologicals

- ✓ Registration needs to be SMART and SLIM and RISK-RELATED

Example: Baculoviruses

- dsDNA-Virus,
- largest insect virus group,
- specific for Lepidoptera, Hymenoptera, Diptera
- Highly specific for few targets



- OECD Consensus document No. 20 (2002):
„baculoviruses are safe for humans, animals and environment“
- REBECA Proposal to **approve baculovirus a.i. on species level** (2006)
- **Realized** in SANCO/0253/2008 rev. 2. (2008)

CONSEQUENCE: fast registration of resistance-breaking CpGV isolates

Referring to QPS status (EFSA BIOHAZ panel) of baculoviruses, they are considered as **low risk on family level** (proposed amendment of (EC) No.1107/2009)

Microbial Biocontrol Agents: Most will be Low Risk Substances



Substance	Category	Status under Reg. (EC) No 1107/2009	Date of approval
<i>Bacillus amyloliquefaciens</i> strain FZB24	Fungicide	Approved	01/06/2017
Cerevisane	Plant activator	Approved	23/04/2015
COS-OGA	Elicit./Fung.	Approved	22/04/2015
Ferric phosphate	Molluscicide	Approved	01/01/2016
<i>Isaria fumosorosea</i> Apopka strain 97 (formely <i>Paecilomyces fumosoroseus</i>)	Insecticide	Approved	01/01/2016
Mild Pepino Mosaic Virus isolate VC 1	Elicitor	Approved	29/03/2017
Mild Pepino Mosaic Virus isolate VX 1	Elicitor	Approved	29/03/2017
Pepino mosaic virus strain CH2 isolate 1906	Elicitor, Virus inoculation	Approved	07/08/2015
<i>Saccharomyces cerevisiae</i> strain LAS02	Fungicide	Approved	06/07/2016
<i>Trichoderma atroviride</i> strain SC1	Fungicide	Approved	06/07/2016

Lessons learned

- ✓ Not only fire fighting but improved fire safety is needed
- ✓ Re-thinking the paradigmas: IPM is not a tool box but a multicomponent system!
- ✓ Harmonization of registration should facilitate regulatory process in general BUT it caused loss of agents in the past (some never came back)
- ✓ Because of specificity, single biological solutions have inherent restrictions of applications (market)
- ✓ Be aware of strength and weakness of regulatory process
 - *Essential legal framework for producers farmers, and consumers*
 - *Regulatory process needs to be risk-related*
 - *Current conditions hampers registration of small products*
- ✓ New pathes needed, not running faster in the treadmill