

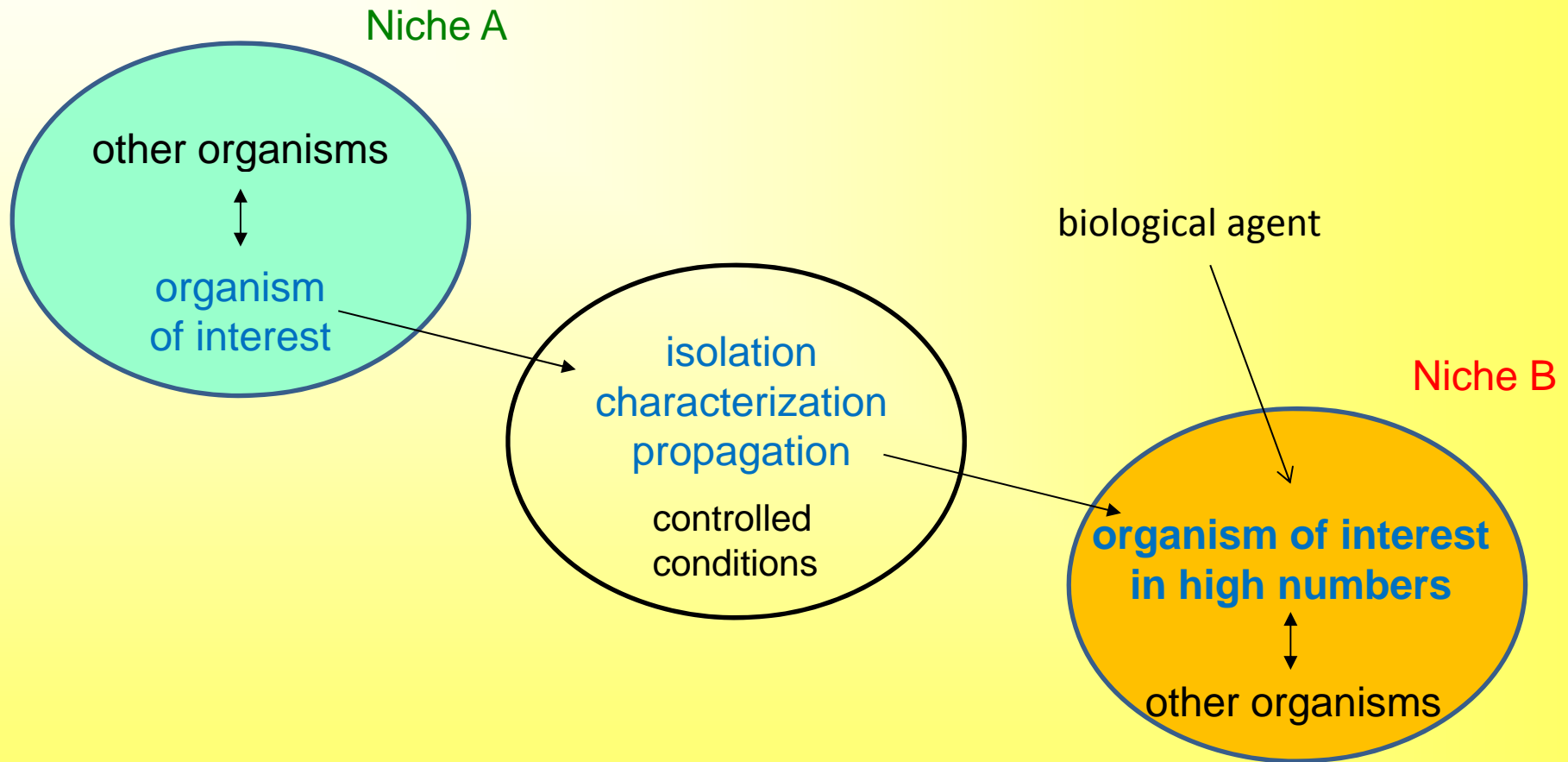
Microorganisms cross borders: open questions for company and science

- Basic ideas
- Example
- Regulations to discuss

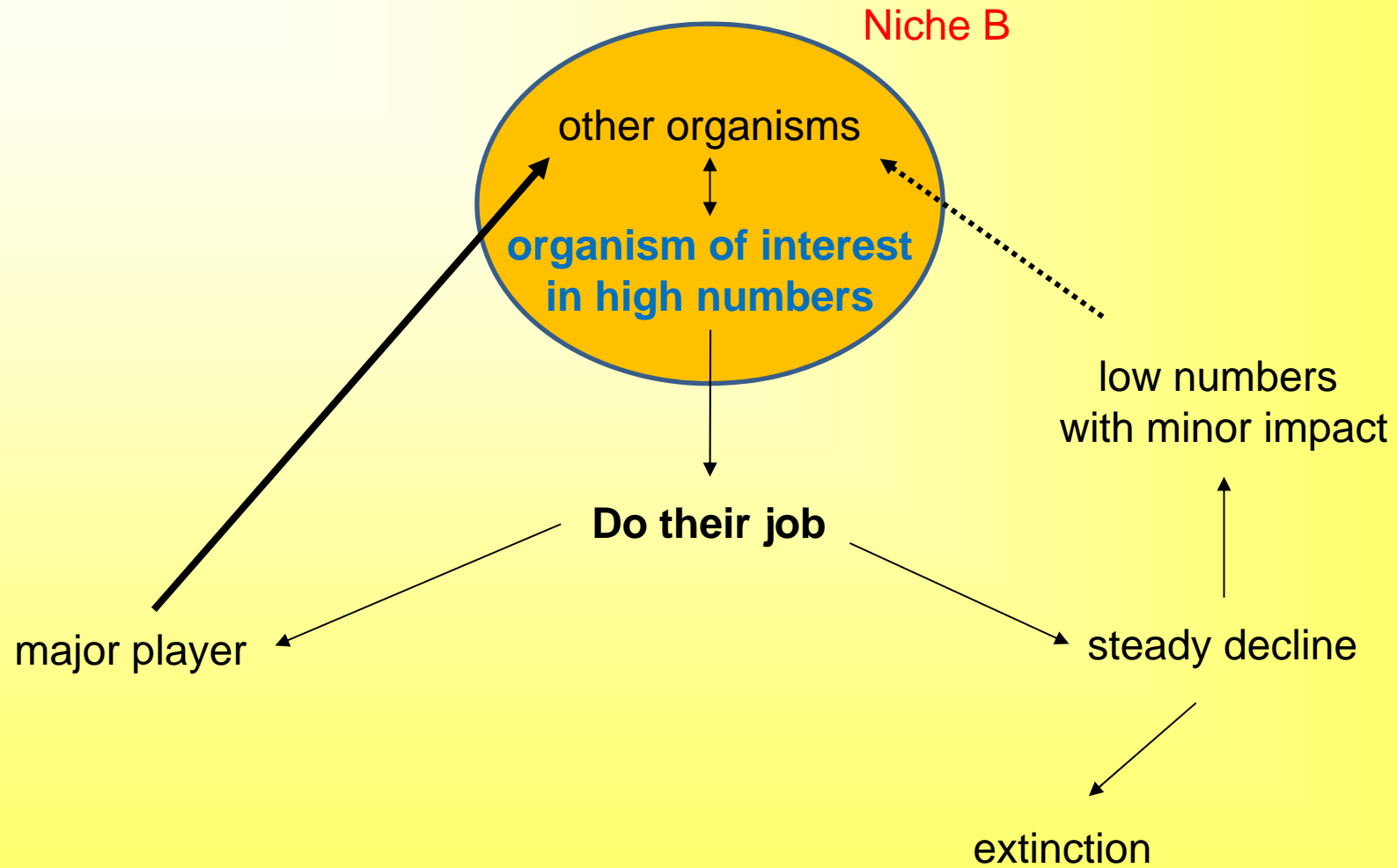
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What we are doing



What could happen



Examples from ,Macroorganisms‘

Lonicera henryi **actively introduced** from East Asia for greening of city areas and is now spreading into forests



Source: waldwissen.net

actively introduced 1934
in Northern Hesse



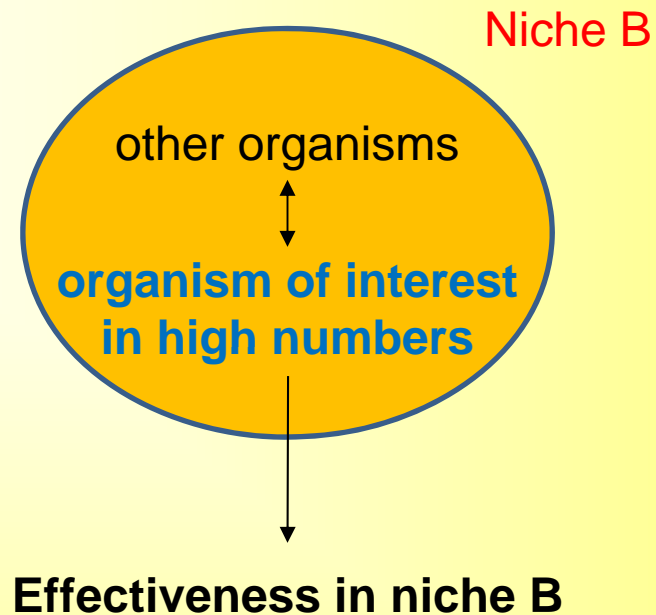
Source: welt.net

Devil's fingers **passively introduced** from Australia



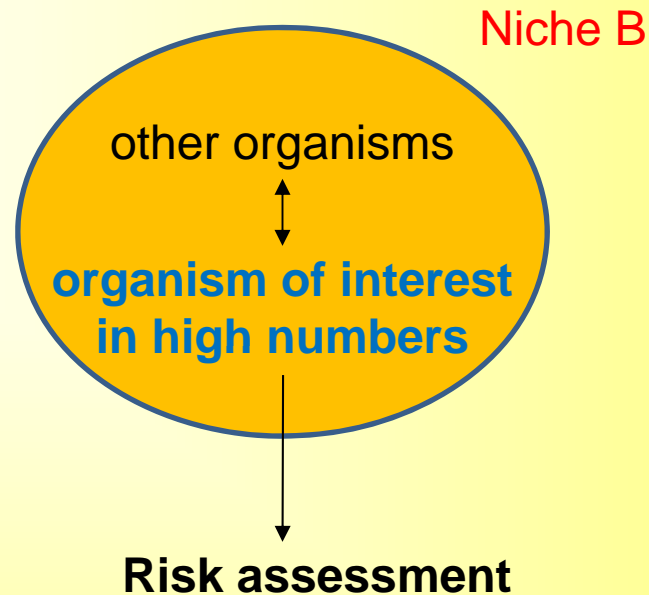
Source: natur-portraet.de

What we need to show



- direct or indirect improvement
 - of plant performance (concentration of substance of interest x biomass of marketable product)
 - in niche b (defined abiotic and biotic conditions as nutrient deficiency, drought, soil contamination, pathogen pressure etc.)
 - (right controls, statistics)
- biological principle

Do we need to show?



- not invasive
 - because indigenous
 - because not viable (e.g. frost sensitive)
 - because not competitive (no significantly increased population density compared to indigenous related organisms after one vegetation period)
- no negative impact on human health and environment
 - significant negative impact on other organisms are specific and well defined (for plant protection products) or not known (for biostimulants)
 - at least 5 years safe handling without any incidence of diseases or allergies

Example

- *Piriformospora indica* (Sebacinales, Basidiomycota)
- root endophytic fungus
- easy to cultivate
- broad host spectrum
- plant growth-promoting effects



Varma et al. 1999



Verma et al. 1998



H. Baltruschat, personal communication

Effectiveness in different niches

in tissue cultures



Varma et al. 1999

on plant resistance

control

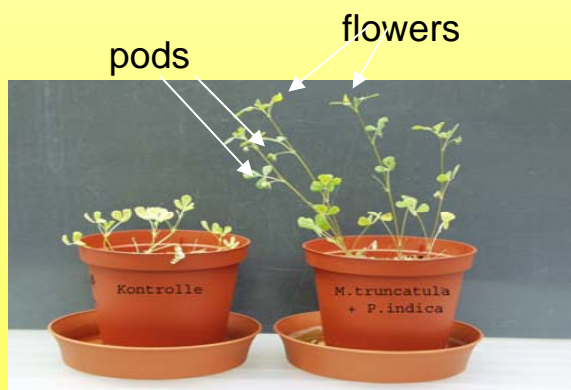
P. indica



barley - *Fusarium culmorum*

Waller et al. 2005

on plant development



Achatz 2002

today more than 80 papers showing

- increase tolerance to abiotic stress
- increased resistance against pathogens
- increased mineral nutrient content
- increased biomasses
- increased contents of essential oils
- showing the biological principle

Risk assessment

- no negative impact on human health and environment?
 - negative impacts on other fungi or bacteria were not shown
 - induced programmed cell death in roots of some plants. This does not result in decreased root performance.
(overall negative effect only, if inoculation density is too high)
 - over 15 years safe handling without any incidence of diseases or allergies
(initially R2 organism, since 2008 R1 organism)
- not invasive?
 - not indigenous (isolated from the Thar desert in India)
 - not 100% frost sensitive
 - competitiveness not yet tested

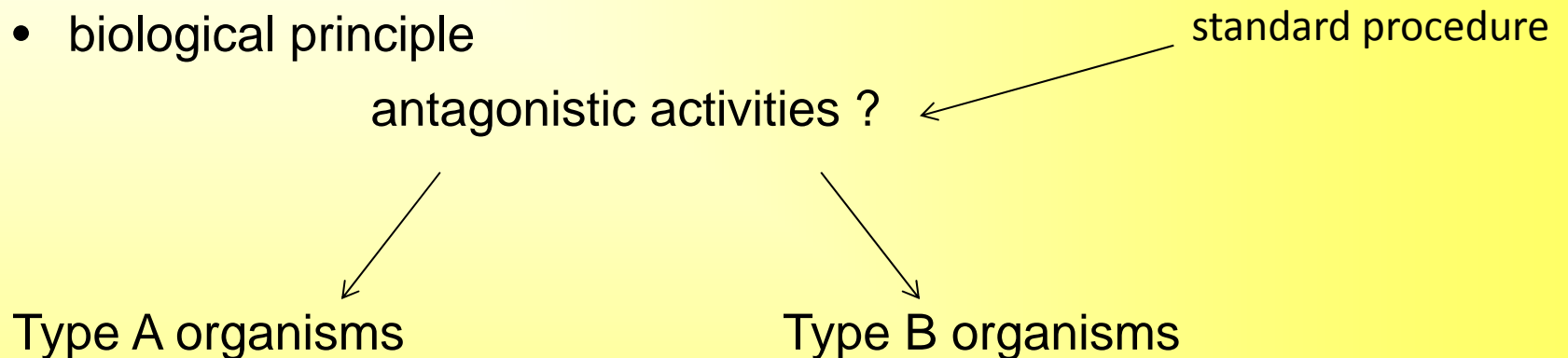
(Isolation of Sebaciniales with related properties from Mid-Europe and North America until now not successful)

For the discussion

Microorganisms could possess a similar invasive character as Macroorganisms.

We therefore need to show under a defined range of conditions (niches):

- Effectiveness (quality)
- biological principle



- spread and survival in soil and in plant (especially important for non-indigenous biological agents)
- impact on soil microbiota and plant endophytes
- at least 5 years safe handling