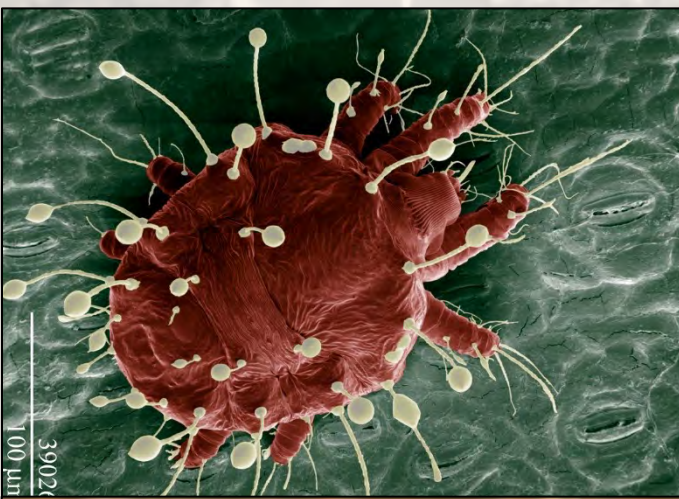


Biosecurity & Bugs

how everything ties
together

Davina Saccaggi



agriculture, land reform
& rural development

Department:
Agriculture, Land Reform and Rural Development
REPUBLIC OF SOUTH AFRICA

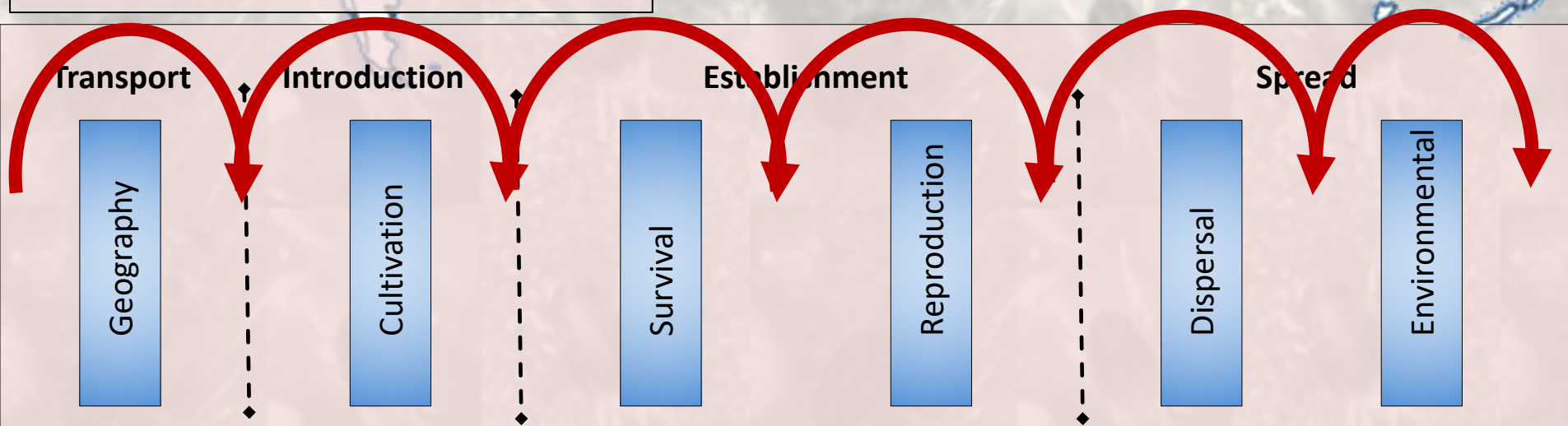


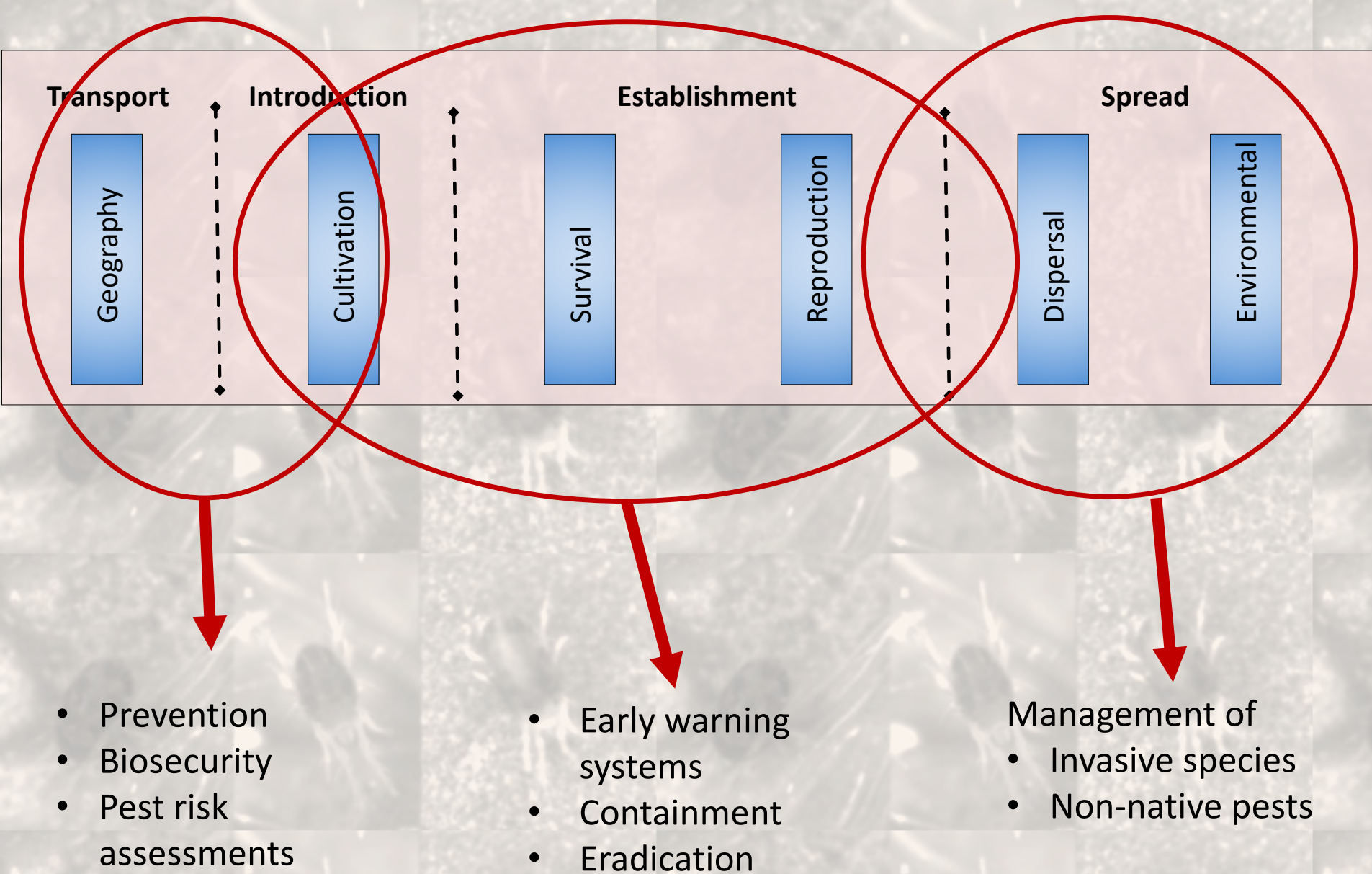
ARC • LNR

Excellence in Research and Development

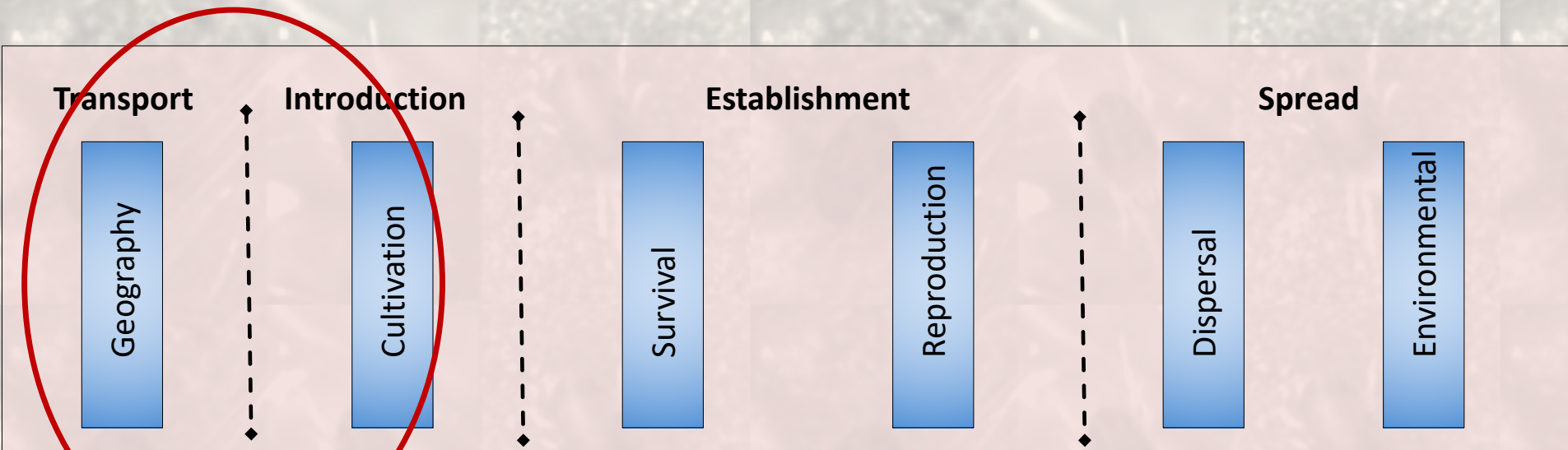


Biological invasion





Biosecurity = Providing security from a biological threat



- Prevention = better **cost:benefit ratio** than later management

BUT

- Prevention
 - Biosecurity
 - Pest risk assessments
- Most difficult aspect of invasion to study or control
 - Especially true of agricultural pests

Biosecurity = Providing security from a biological threat

Biosecurity & Bugs



Why are "bugs"
so problematic?

What can we
do?

Biosecurity & Bugs



Biosecurity on paper:

- Well regulated
- Clearly defined protocols & systems
- IPPC, ISPMs, trade agreements, etc.



Biosecurity in reality:

- Severe capacity limitation
- **Unknown efficacy**

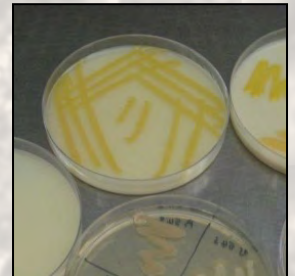
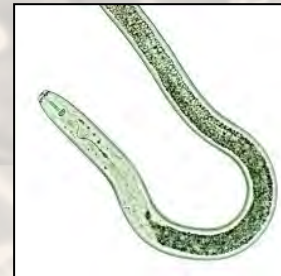
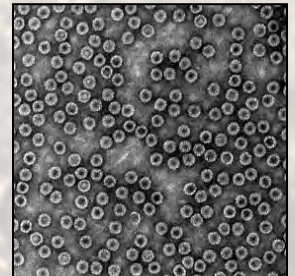
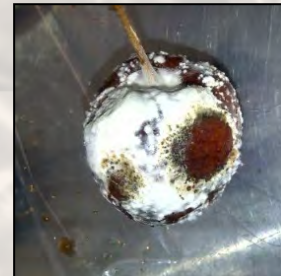


We don't know how effective it is because we don't record what we do!!!



Biosecurity & Bugs

- DALRRD diagnostic records **1994 – 2019**
- **26 291** inspected samples
- **13 731** detections of contaminant organisms

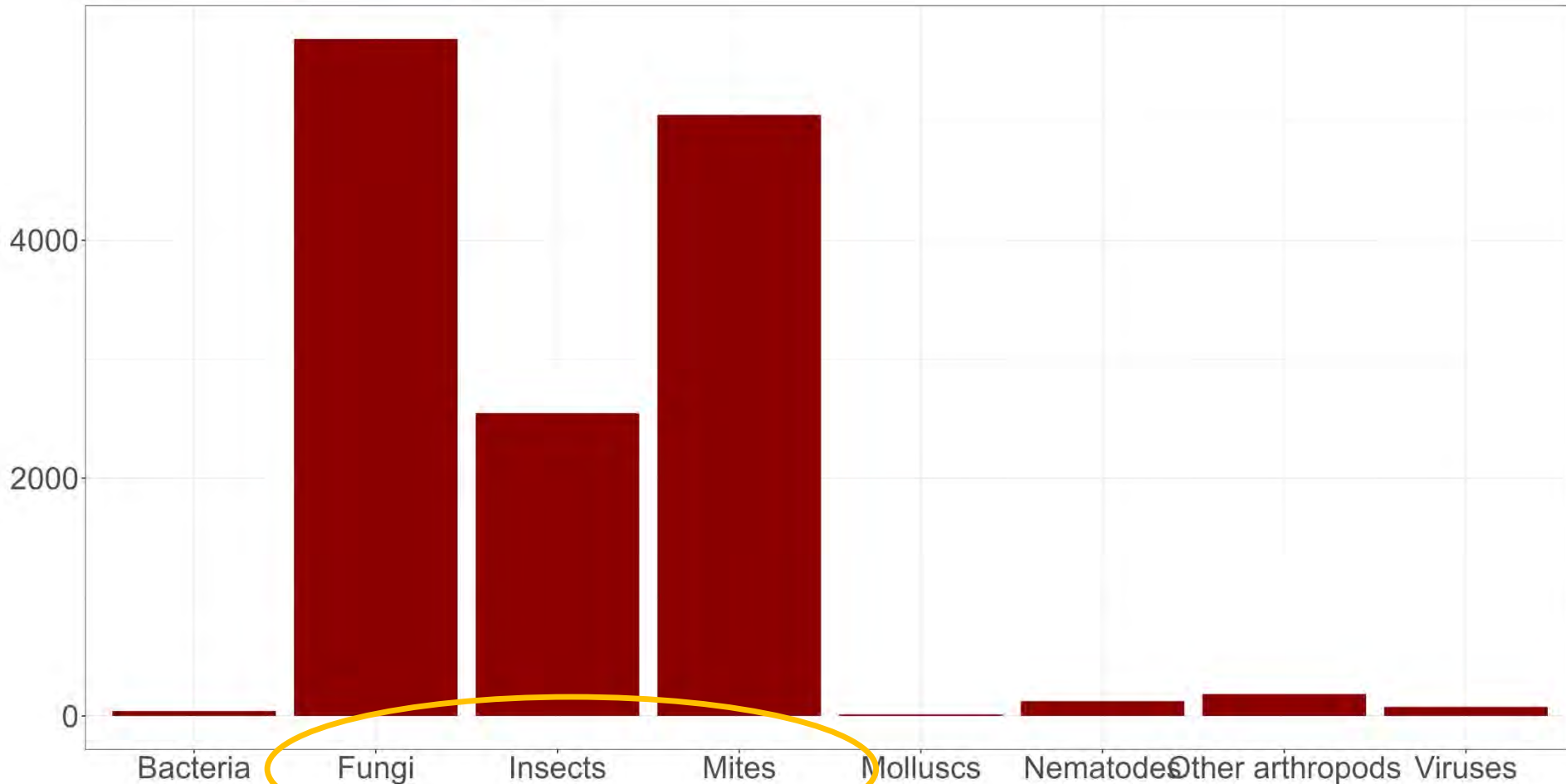


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Biosecurity & Bugs

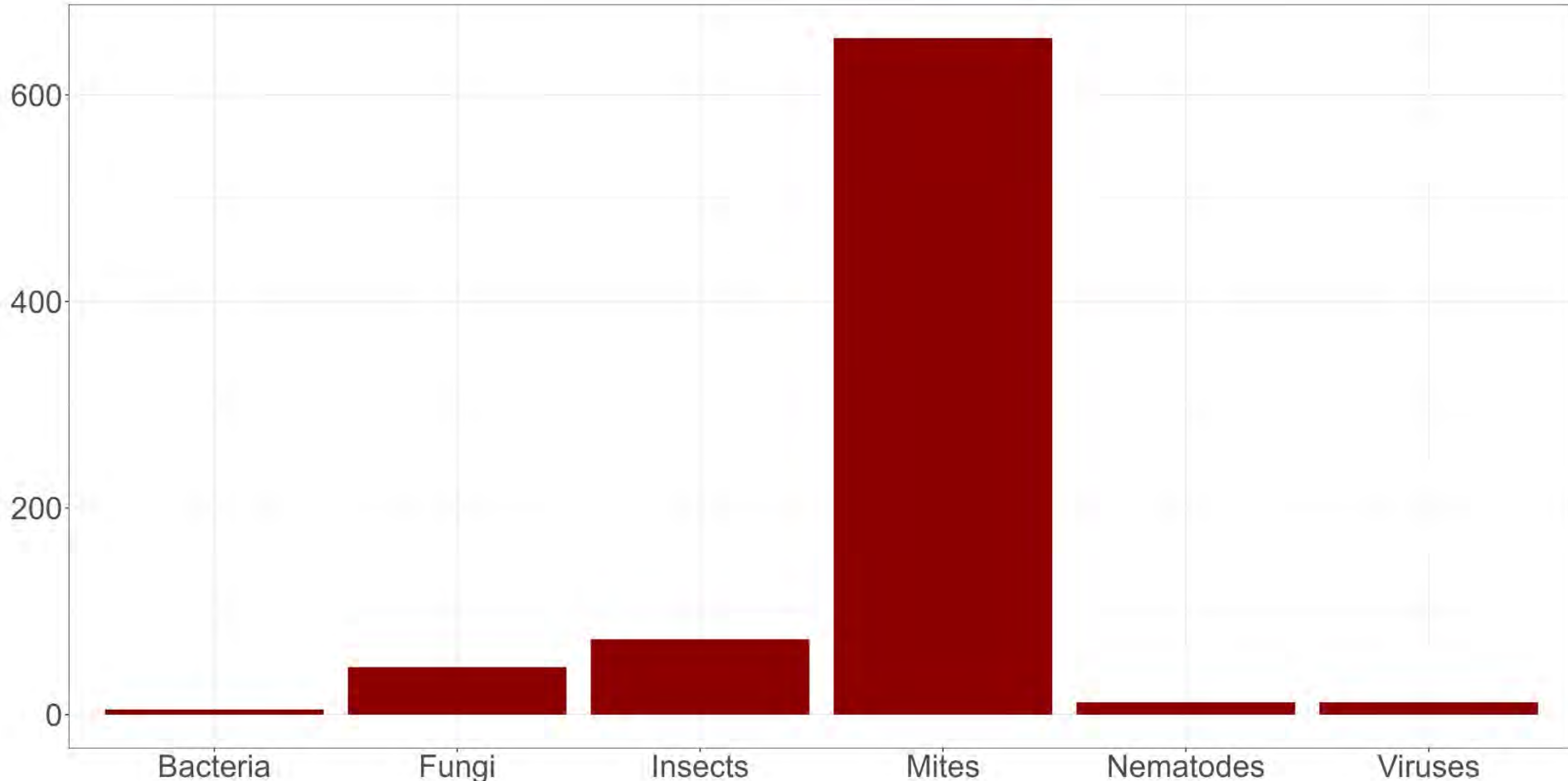
Contaminant organisms found on inspected imported plant products into SA



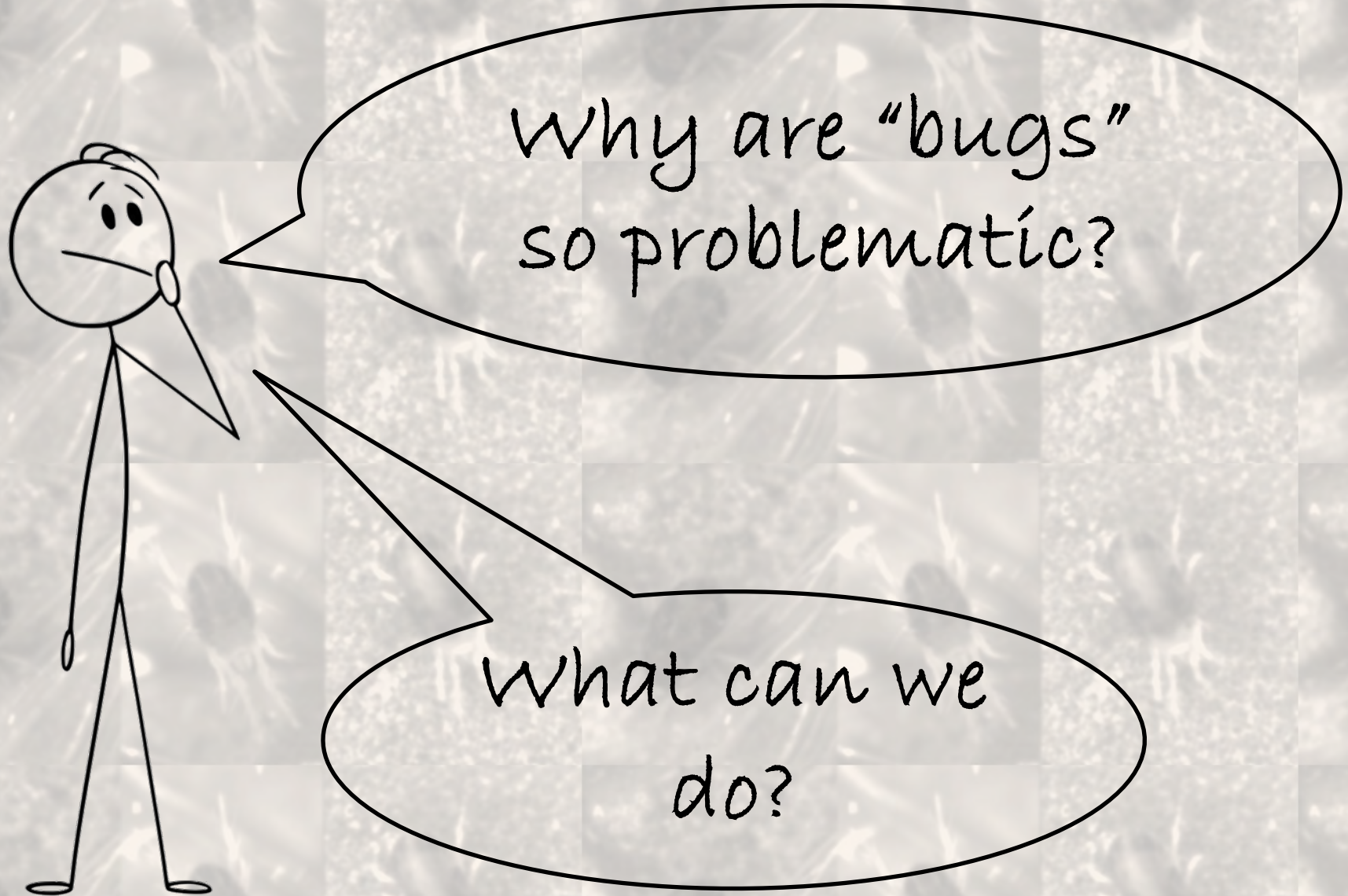
From: Saccaggi et al. 2021. Sci. Data. 8(83):1-11.

Biosecurity & Bugs

Quarantine organisms found on inspected imported plant products into SA

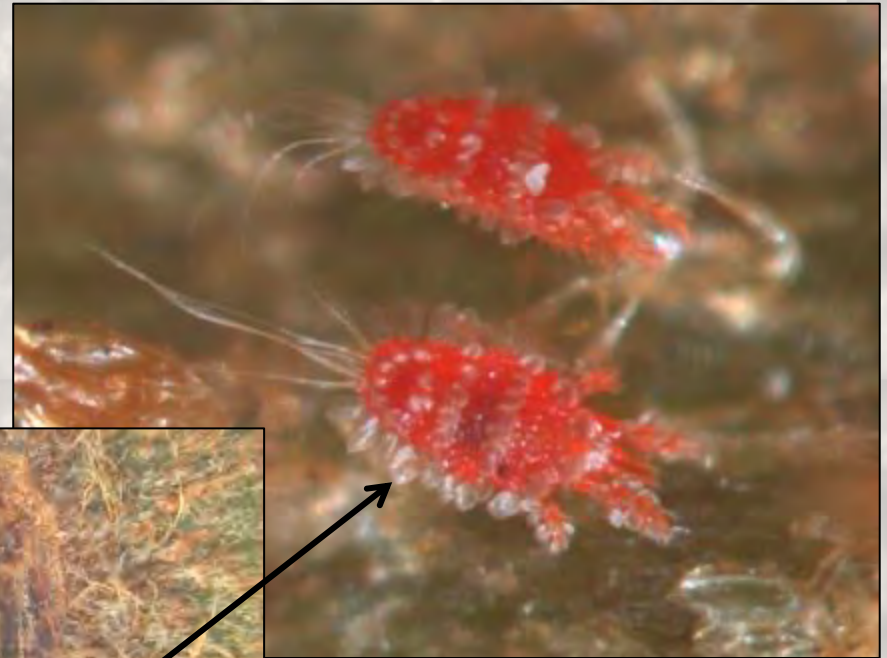


Biosecurity & Bugs



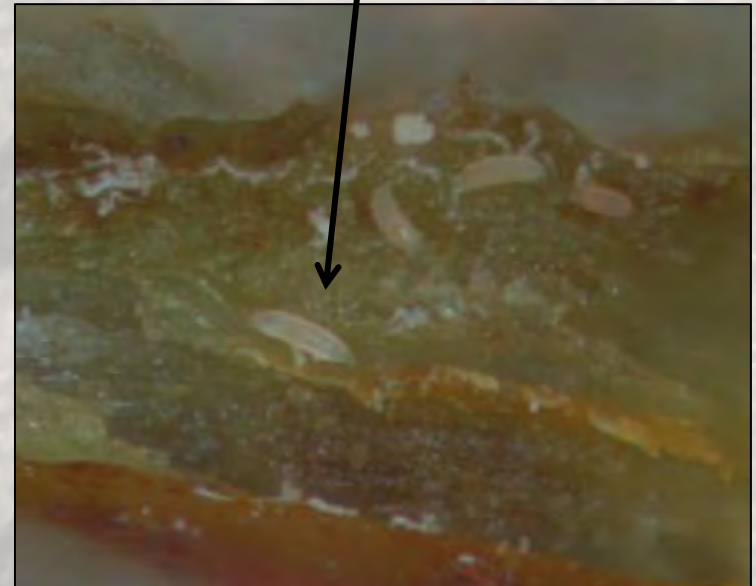
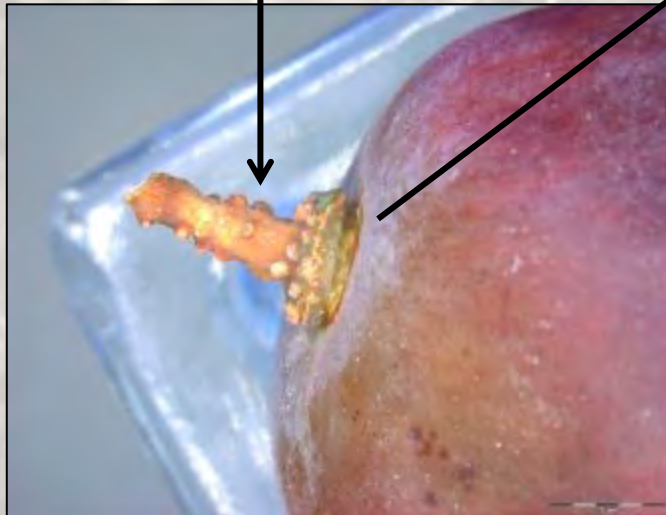
Why
?

Insects & mites are small ...



Why
?

... Very small!



From: Craemer & Saccaggi 2013. IJA. 39(3):239-243.

Why
?

Small size & cryptic habits:

- Difficult to detect in inspections
- Easily “slip-by” quarantine
- Need well-trained personnel
- Need specialised equipment



What to
do?

Small size & cryptic habits:

- Don't rely only on inspections
- Systems approaches
- Invest in training
- Appropriate detection methods





Insects & mites are diverse ...



2007 A flat mite, *Brevipalpus* sp. is intercepted on kiwi fruit from Italy

- Not one of the species in SA
- Similar to *B. lewisi*, which is quarantine
- BUT couldn't identify it

Next 16 years

2010 from Greece

2015 from France

- Multiple interceptions
- Still couldn't identify it



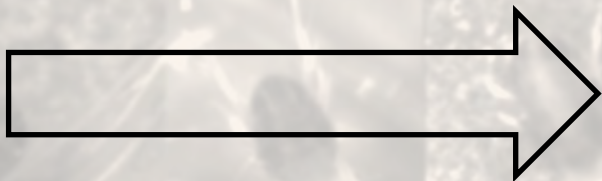


Why couldn't we identify it?

1. **Only adults**
Is kiwi a host for the whole life cycle?
2. **Taxonomy complicated**
Perhaps a new species?
3. **No specimens for comparison**
These are all overseas
4. **Phytosanitary information**
Couldn't ask overseas colleagues

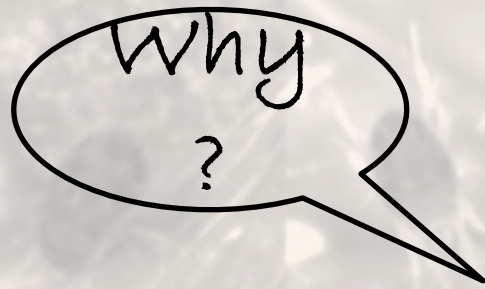
2023

Survey by Italian researchers on kiwi found a *Brevipalpus* sp.
Examine specimens in the Smithsonian (USA)
Contacted me, knowing I'm also working on *Brevipalpus*



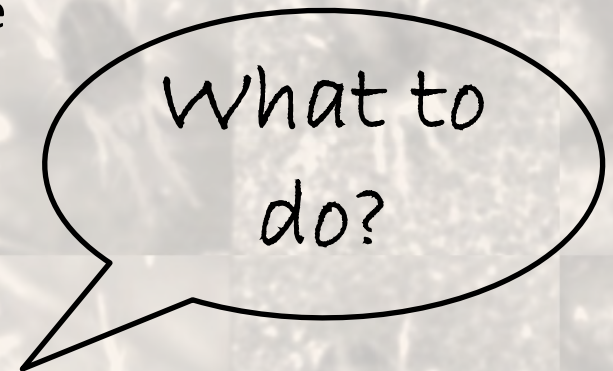
Brevipalpus garmani

From: Saccaggi & Ueckermann 2024. *Acarologia*. 64(2):363-369.



Very diverse:

- Difficult to identify
- Cryptic species & new species
- Biology & pest status unsure
- Biosecurity response unsure



Very diverse:

- Better international collaboration
- Emphasis on taxonomic research
- Risk analysis must include uncertainty



Accidental transport with agricultural products



Accidental transport:

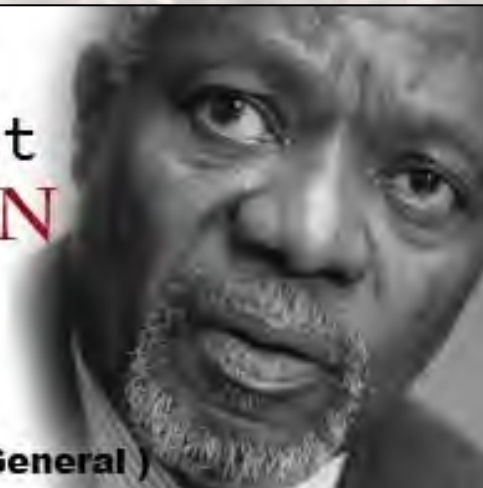
- Difficult to predict
- Cannot control directly

Agricultural products:

- Trade will ALWAYS occur
- Increasing volumes

It has been said that
arguing against
GLOBALIZATION
is like
arguing against
THE LAWS OF GRAVITY

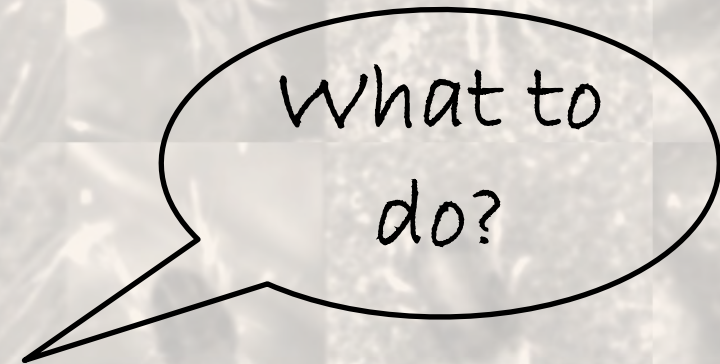
Kofi Annan (Former UN Secretary-General)





Accidental transport on agricultural products:

- Difficult to predict
- Cannot control directly
- Trade will ALWAYS occur
- Increasing volumes



Accidental transport on agricultural products:

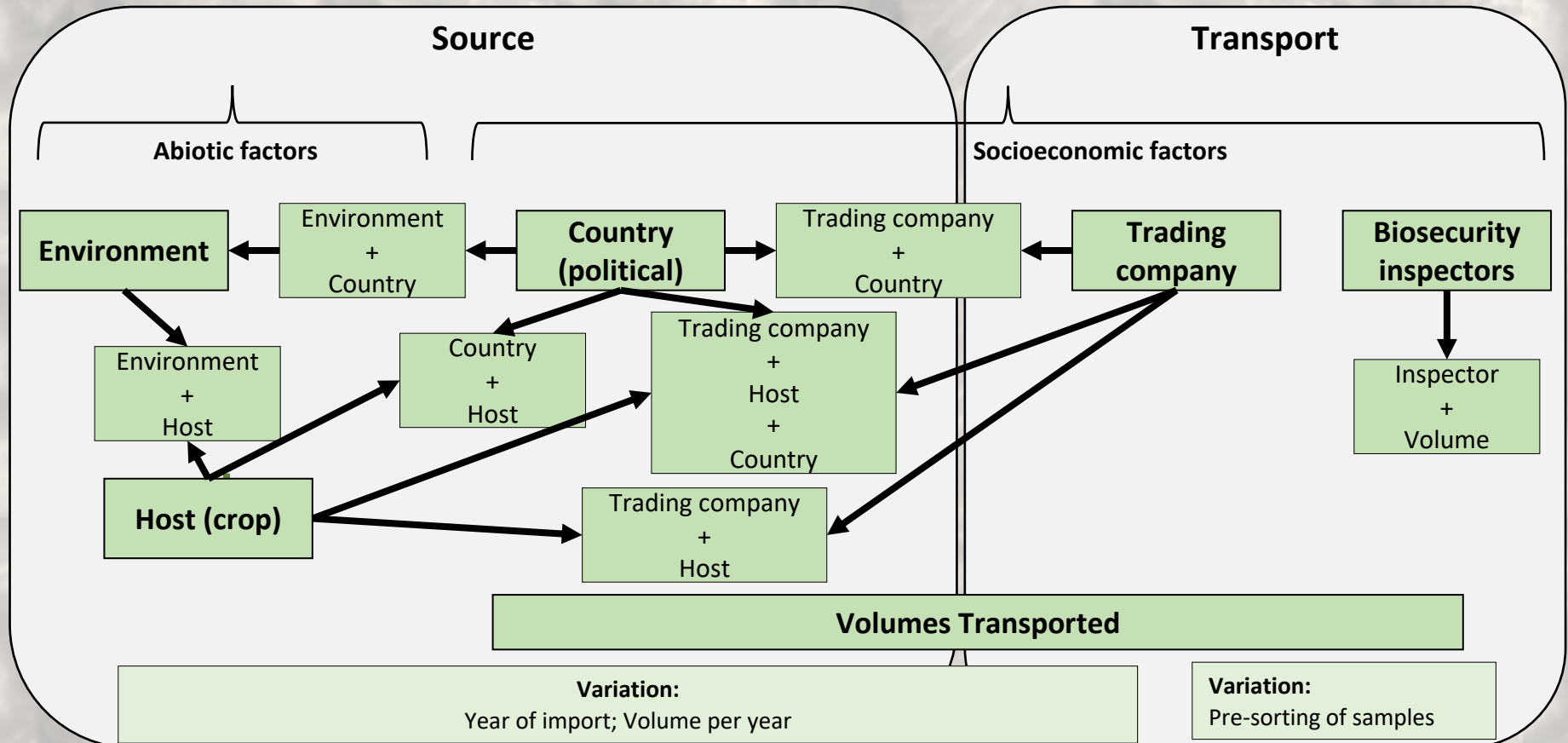
- Study the pathway
- Predict & control high-risk pathways



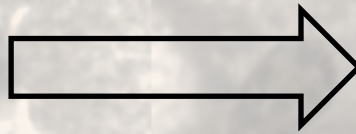
What to do?

Arthropods on imported plant products: Volumes predict general trends while contextual details enhance predictive power

Davina L. Saccaggi^{1,2} | John R. U. Wilson^{3,4} | Andrew P. Robinson⁵ | John S. Terblanche²



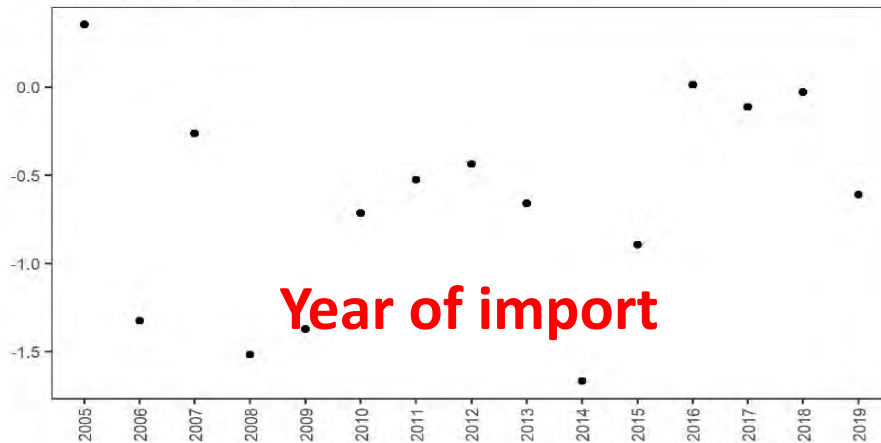
- Pathway characteristics
- Machine learning



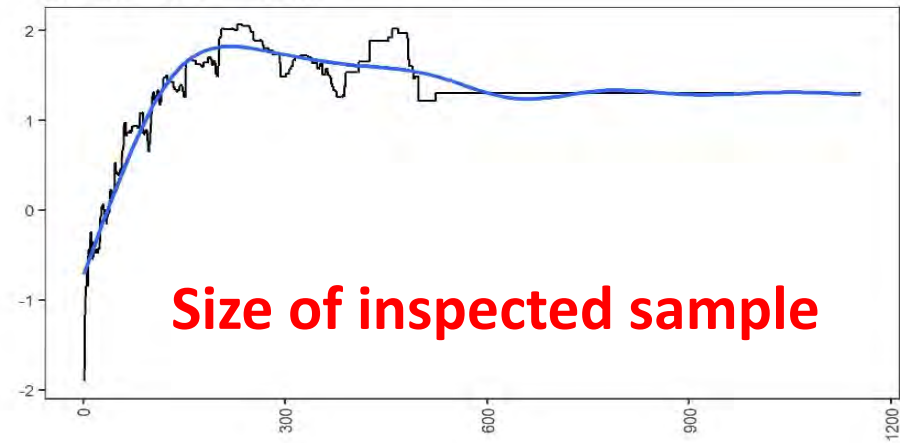
Find most influential characteristics

Model: Inspected volumes (with time and sample variation)

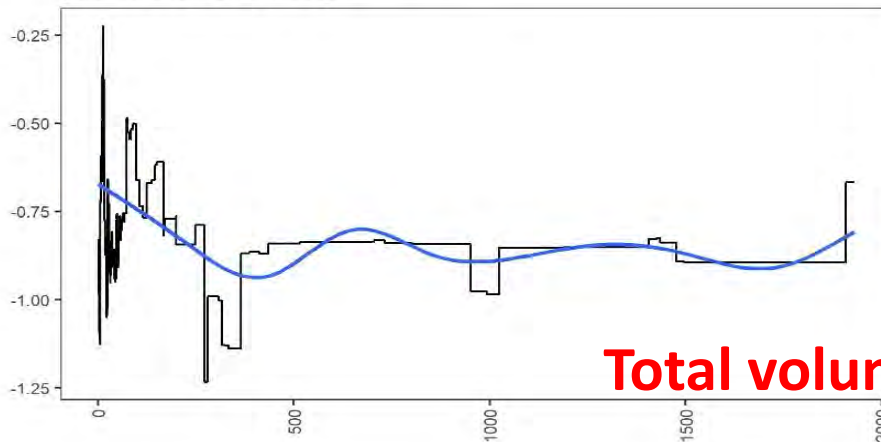
Year of import
(relative influence = 31%)



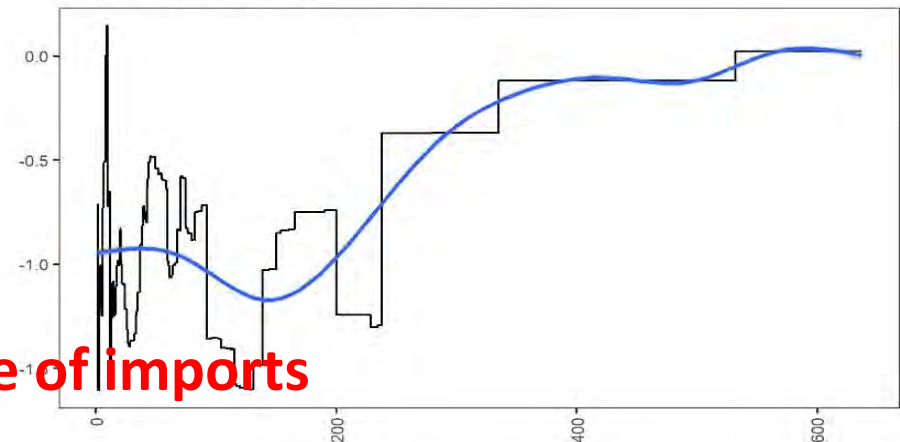
Inspected volume (fruit/plants) per sample
(relative influence = 15.6%)



Inspected volume (total samples) per importer
(relative influence = 12.3%)

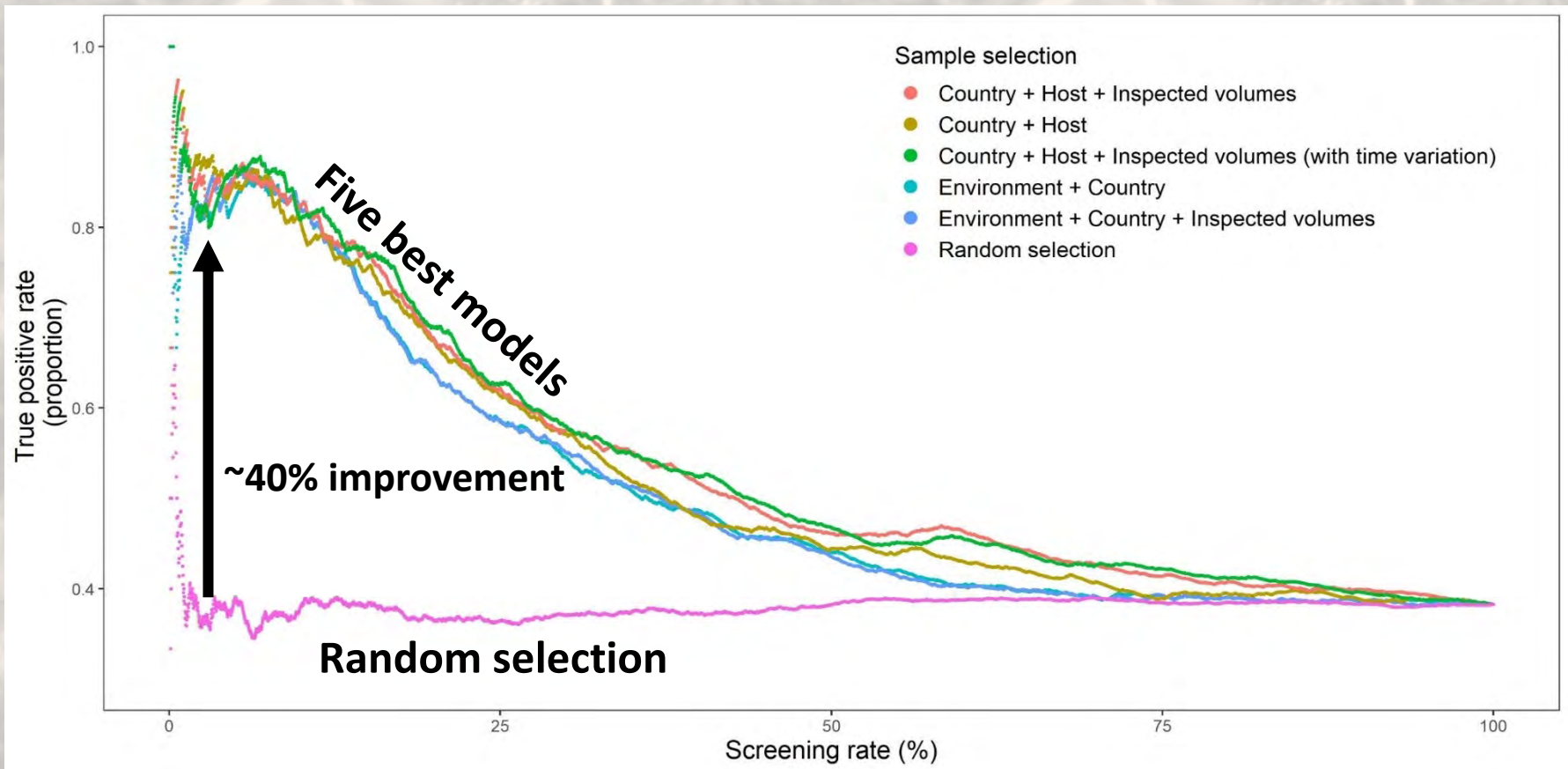


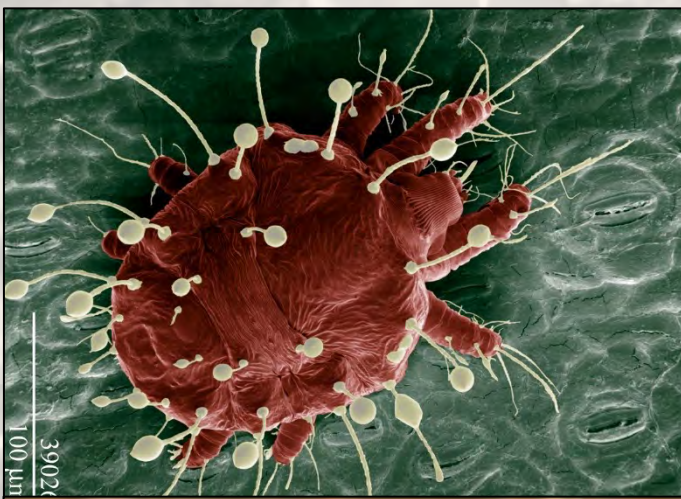
Inspected volume (total samples) per exporter
(relative influence = 11%)





**Develop a prediction model to direct
sampling & inspection**





What can
we do?



1. Focus on the pathway

Pathway risk assessments
Manage the pathway as a whole

2. Idiographic approach

Different approaches for
different problems

3. Invest in people

Trained, experienced,
motivated personnel