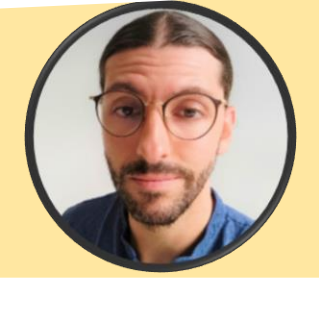


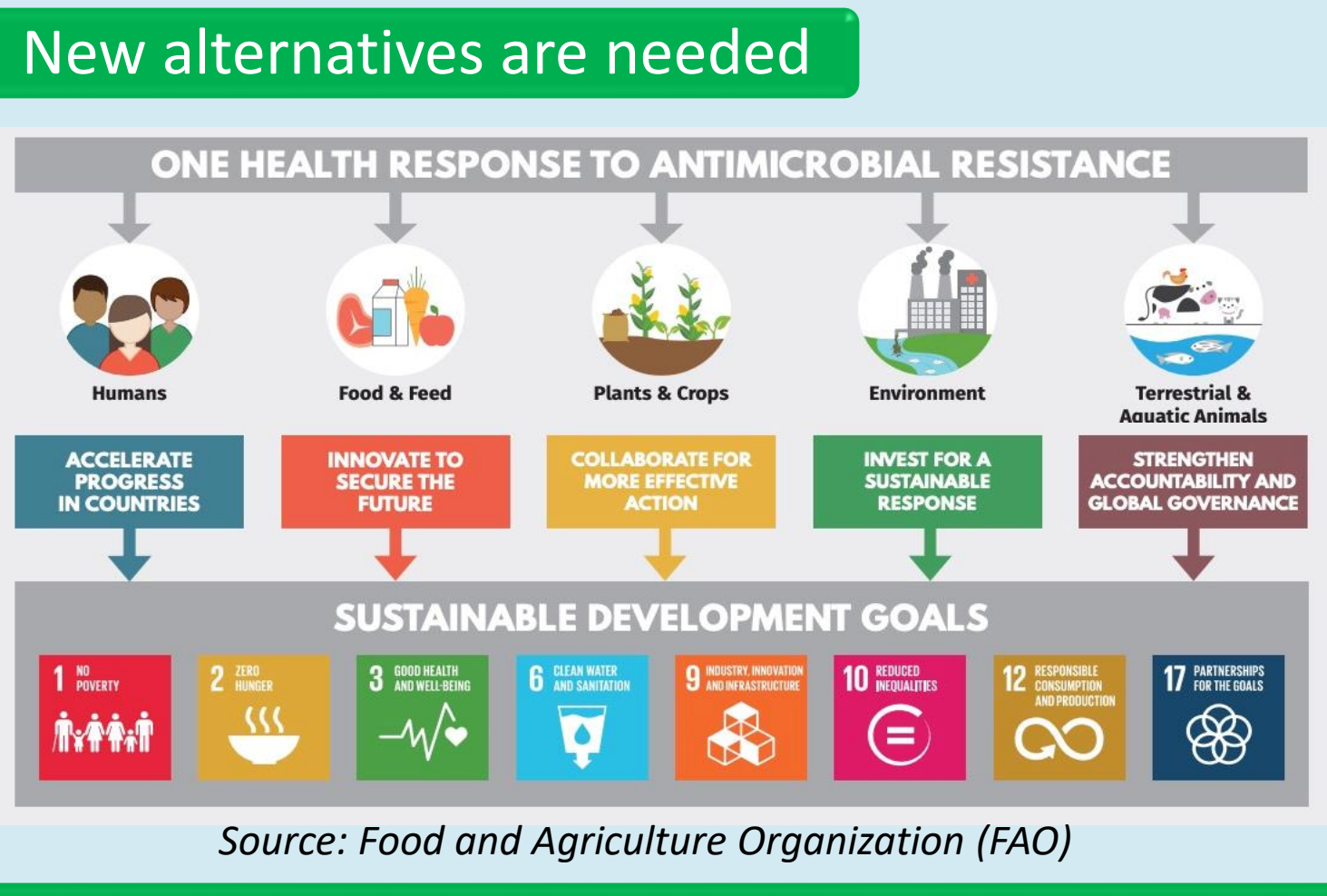
# Innovative enzymes for controlling bacterial phytopathogens



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## BACKGROUND: Rise of antibioresistance



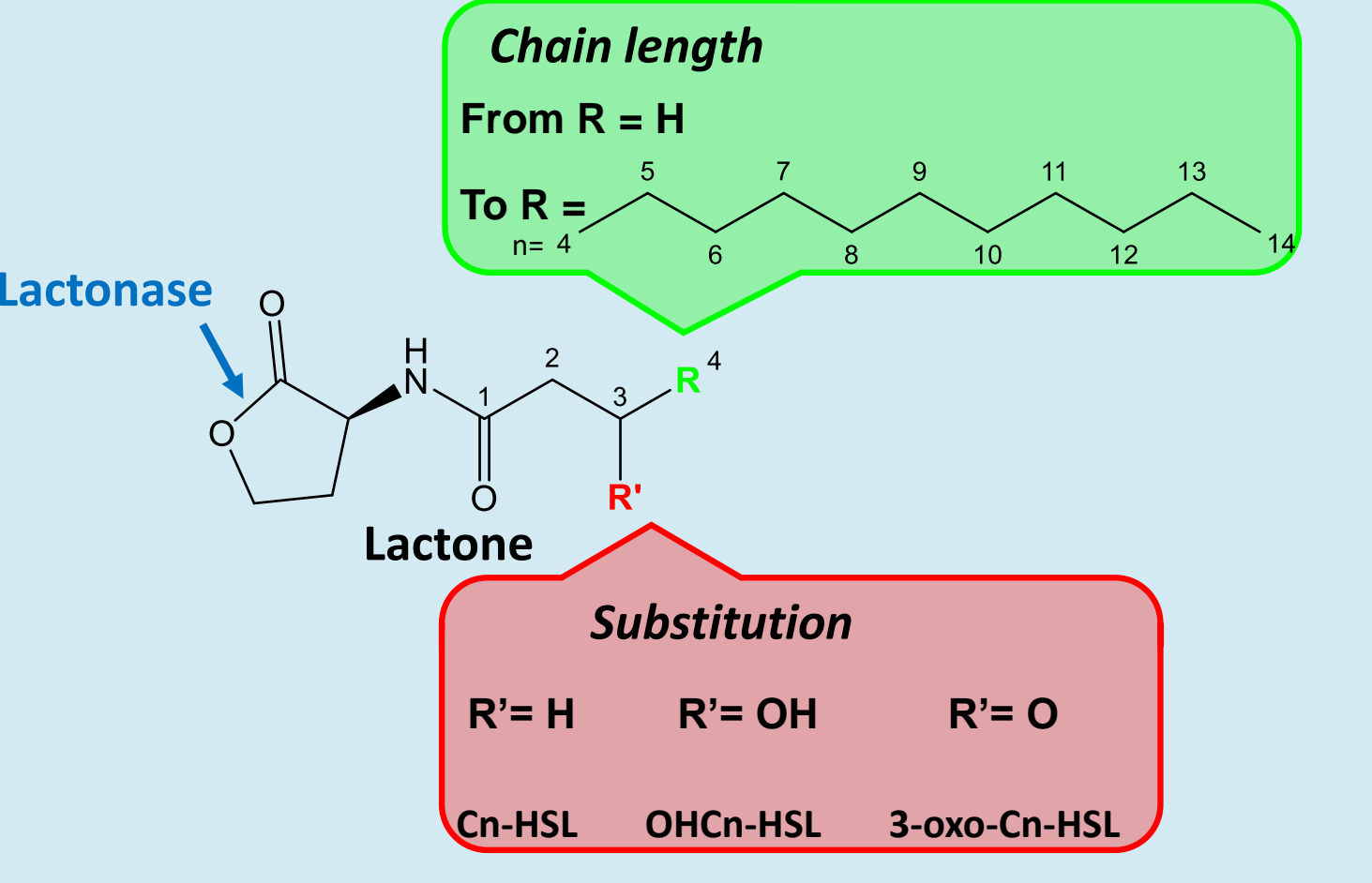
**ONE HEALTH**

**Objective:** improve the health of humans, animals, plants, and the environment while contributing to sustainable development.

- Develop alternatives to decrease antibiotic use
- Increase food security by fighting against crop pests
- Implement sustainable treatments to preserve biodiversity

**International call for alternative antimicrobials**

## Bacteria communicate using various Acyl homoserine lactones (AHLs)

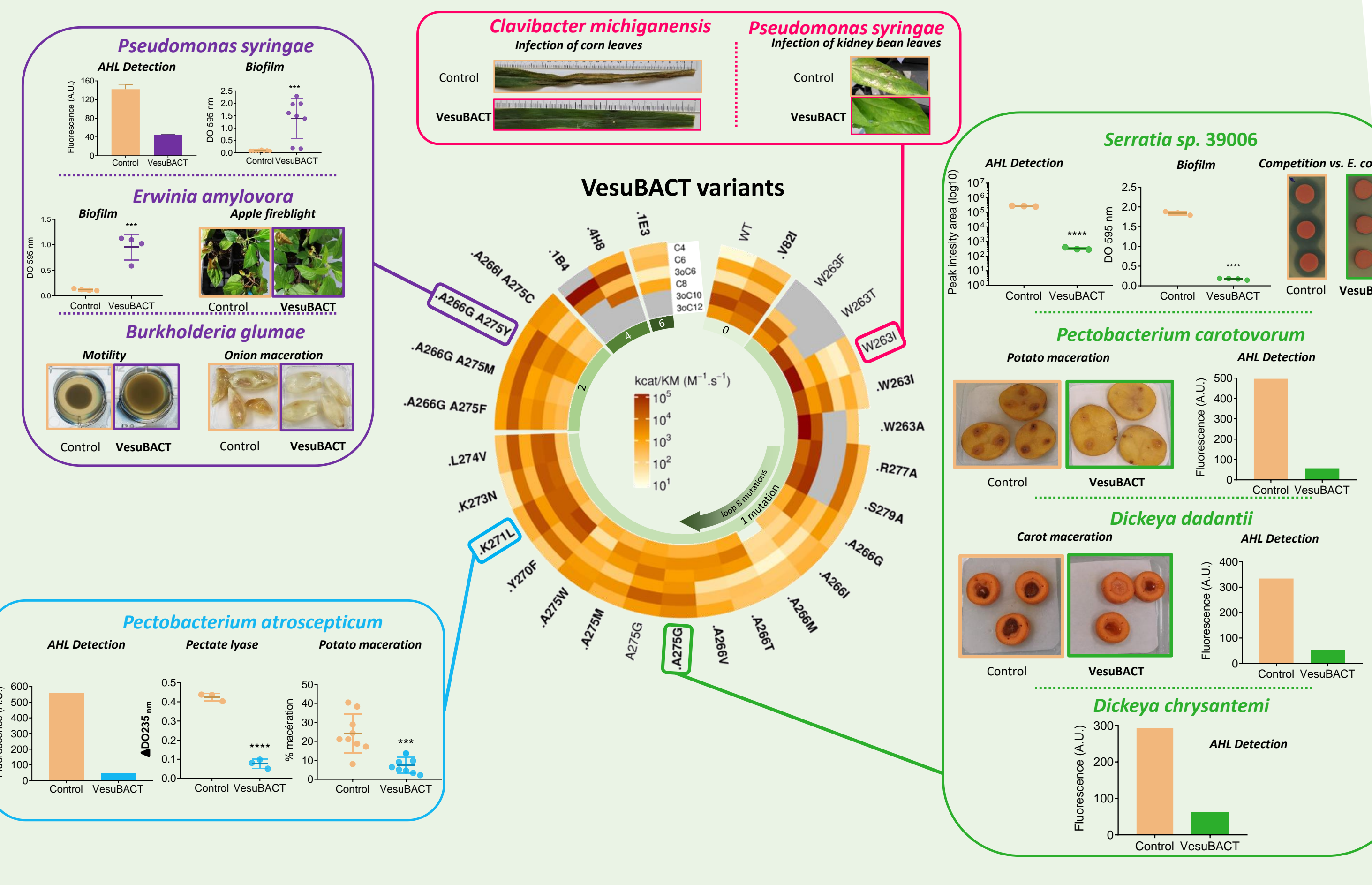


Phytopathogens use a wide panel of AHL. These AHL are involved in a broad variety of plant diseases. These diseases are responsible for important losses worldwide.

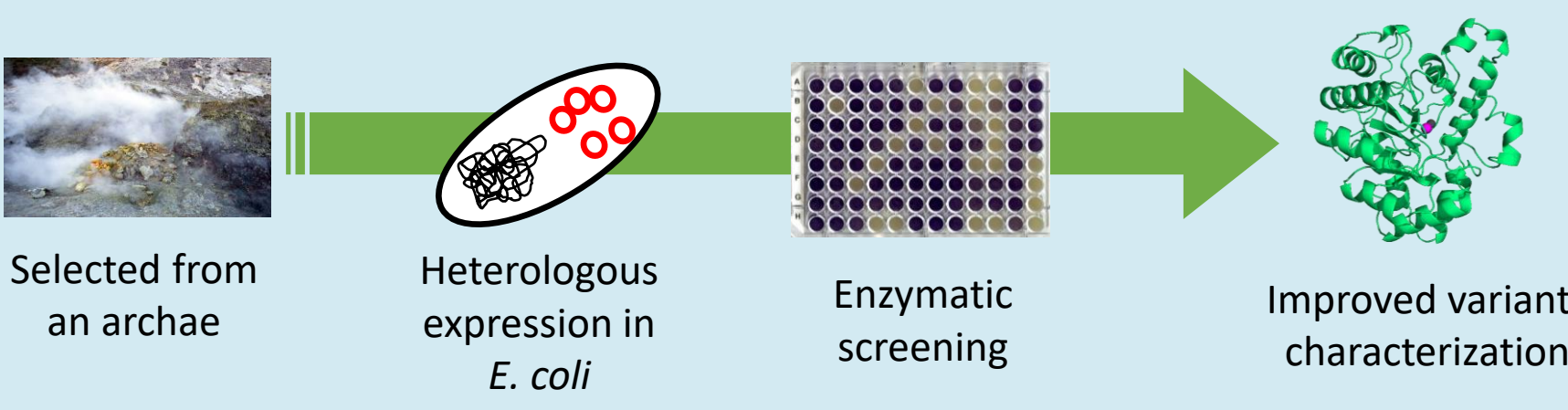
Bacteria	HSL	3-oxo-HSL	3-OH-HSL
<i>Vibrio harveyi</i>	-	-	C4
<i>Chromobacterium violaceum</i>	C9, C10, C11	C10, C12	C10, C11
<i>Pseudomonas aeruginosa</i>	C4	C12	-
<i>Serratia sp. 39006</i>	C4, C6	-	-
<i>Dickeya dadantii</i>	C6, C10	C6	-
<i>Pectobacterium atrosepticum</i>	C8	C6, C8	-
<i>Erwinia amylovora</i>	C8	C6	-
<i>Pseudomonas syringae</i>	-	C6	-

## INNOVATION: Engineered enzymes to target various pathogens

Phenotypic assays *in vitro*: selecting the best variant for each pathogen



## SsoPox, a hyperthermostable lactonase, engineered to generate specific variants



**Hyperthermostable enzyme (>100°C)**

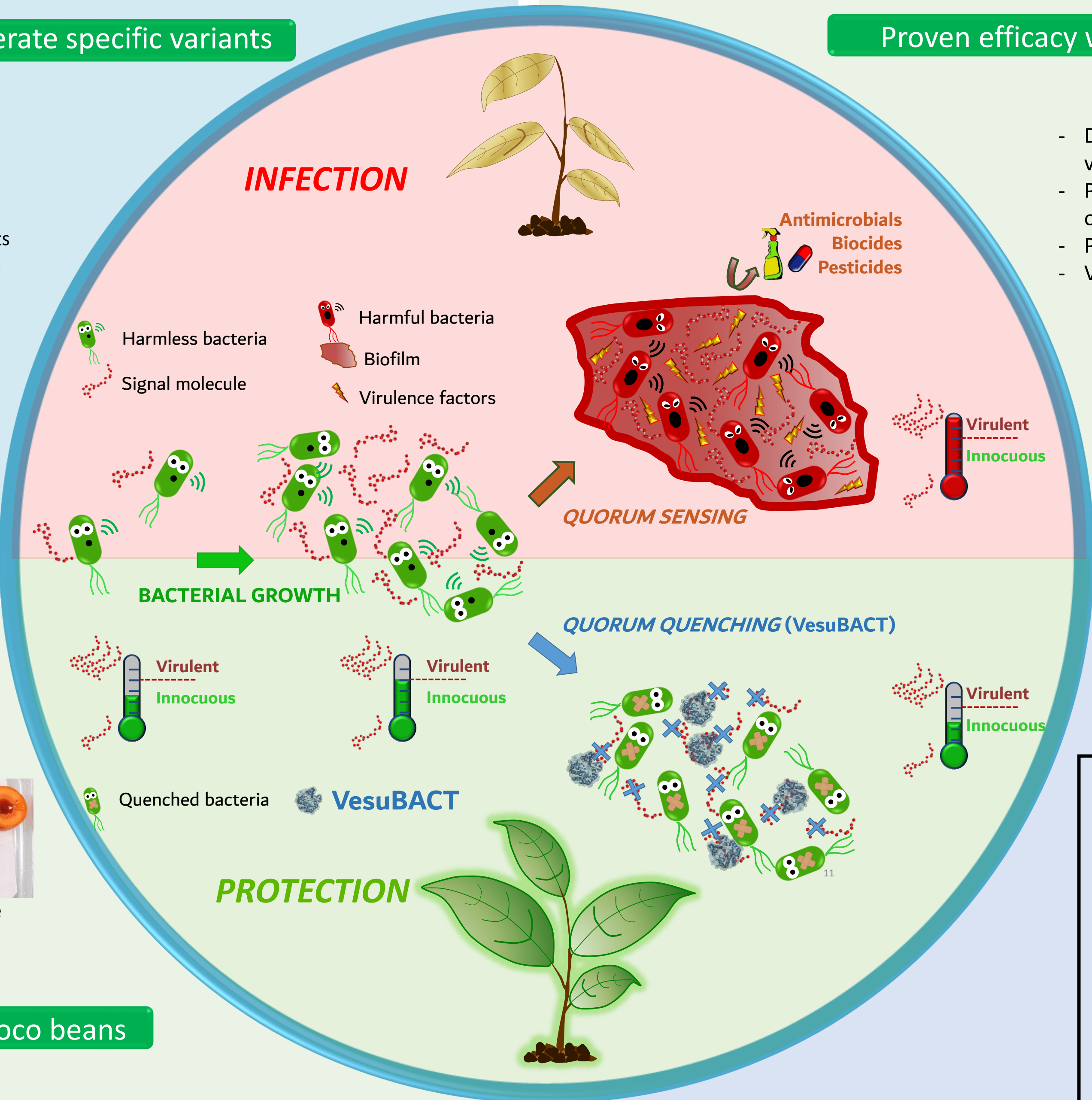
- Active from -18°C to 100°C
- Tolerant to industrial processes
- Long-term storage

A very robust enzyme compatible with protein engineering and industrialization constraints

## Proven efficacy with fine microbiological and 'omics' approaches

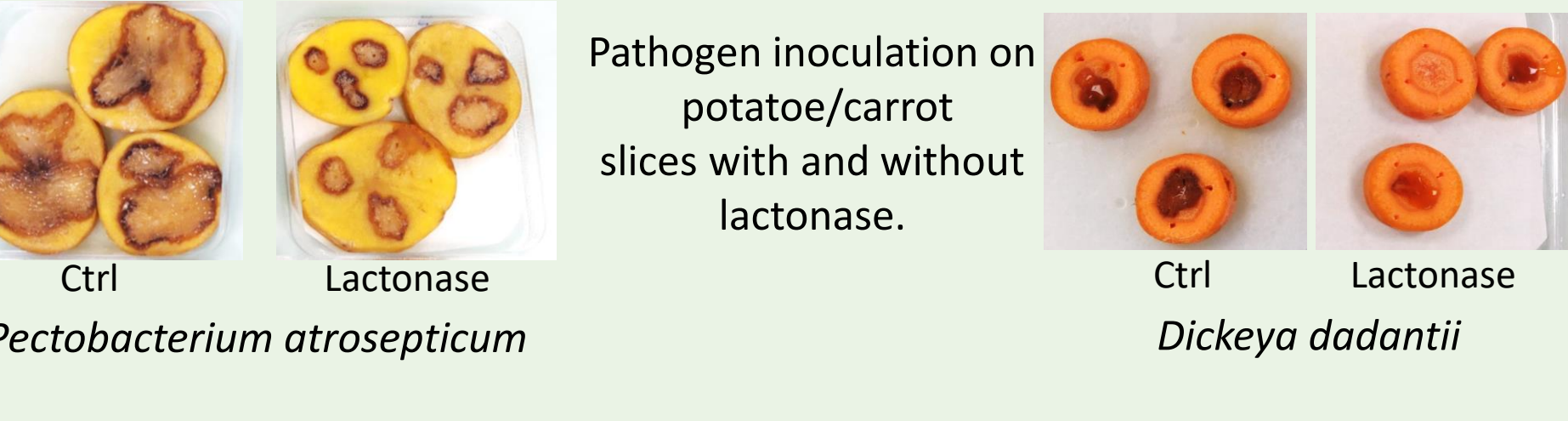
- Development of several phenotypic screening assays to determine best fitted variant for *Quorum* quenching.
- Proteomic and metabolomic analyses to assess complete impact of QS and QQ on specific pathogen, under specific conditions.
- Priority diseases: **Fireblight, bacterial canker, soft rot, black leg**
- Validating **biostimulation** and **biopesticide** effects in *planta*

**VesuBACT enzymes efficiently disrupt quorum sensing and decrease bacterial infections in various pathosystems**

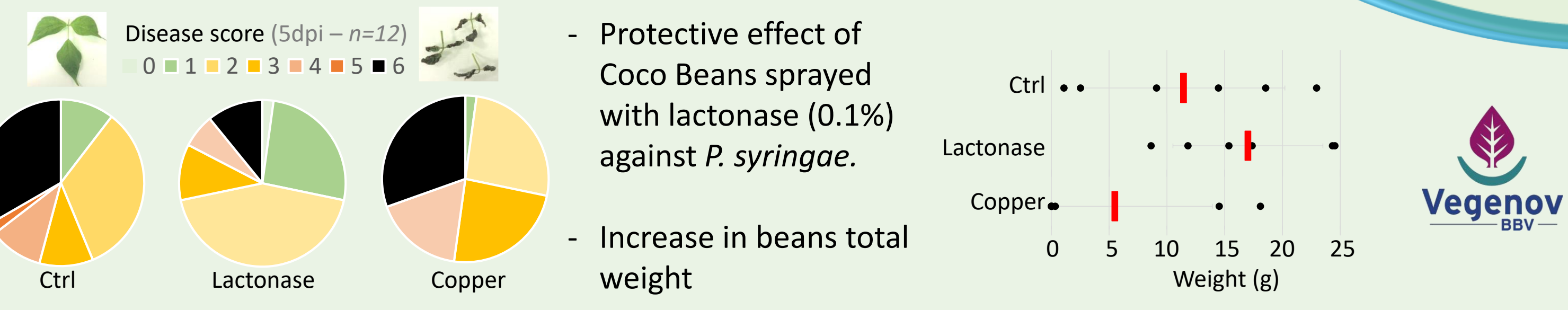


## FOCUS: In planta assays and POC

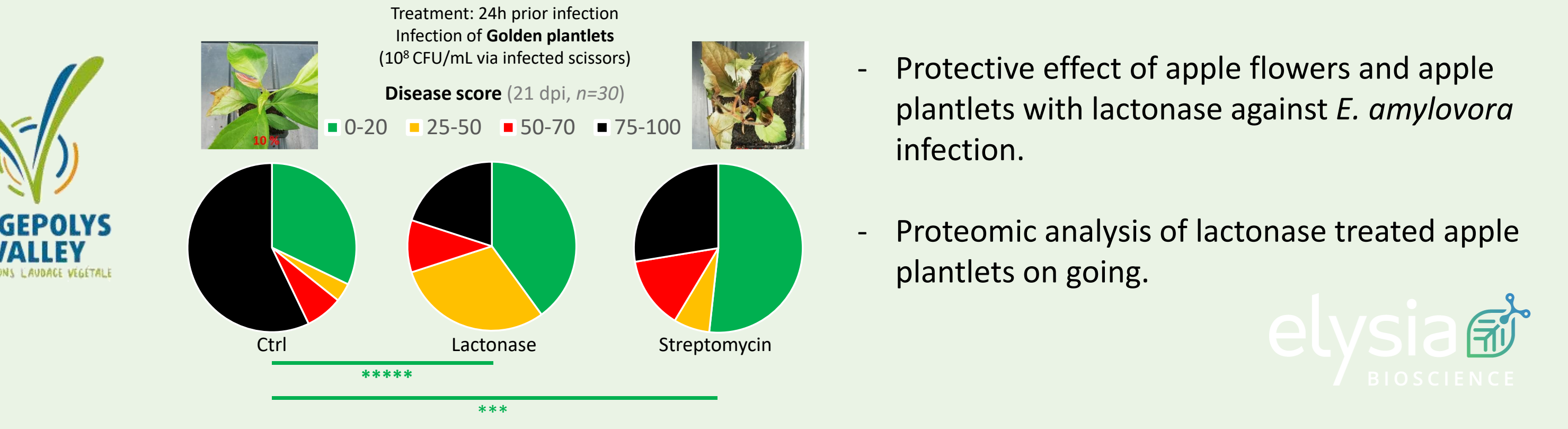
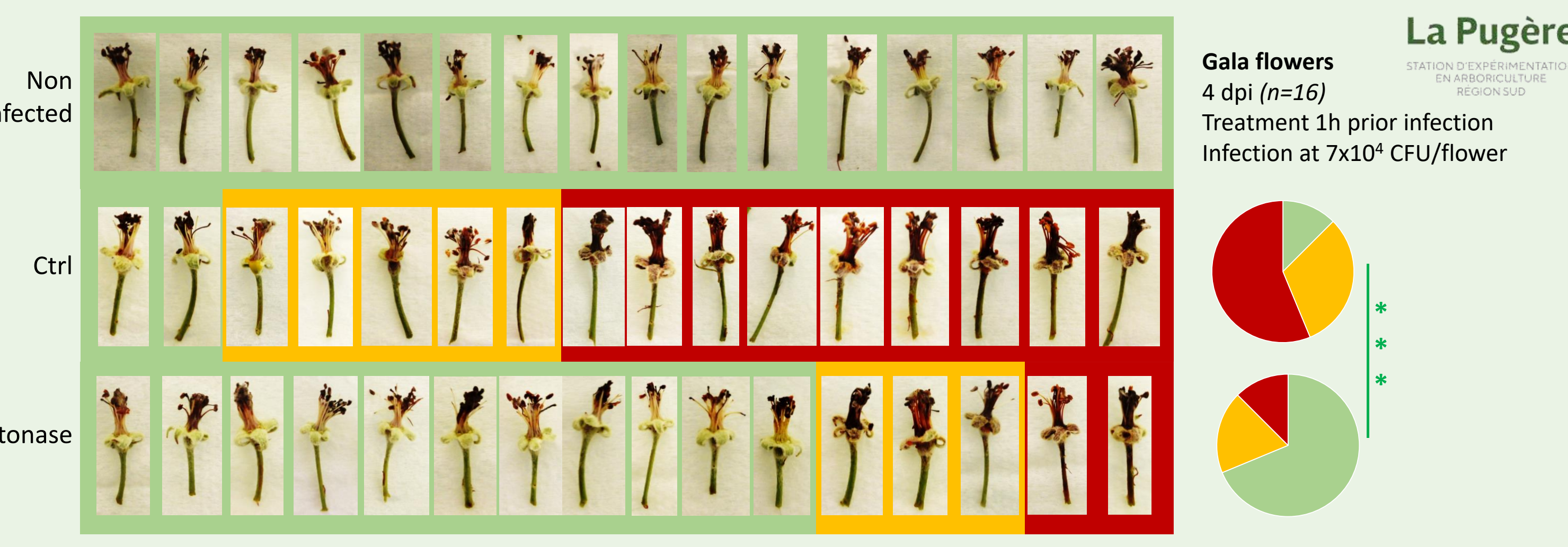
### Soft rot: *In vitro* host plant maceration assays



### Bacterial canker: *P. syringae* infection assays on Paimpol Coco beans

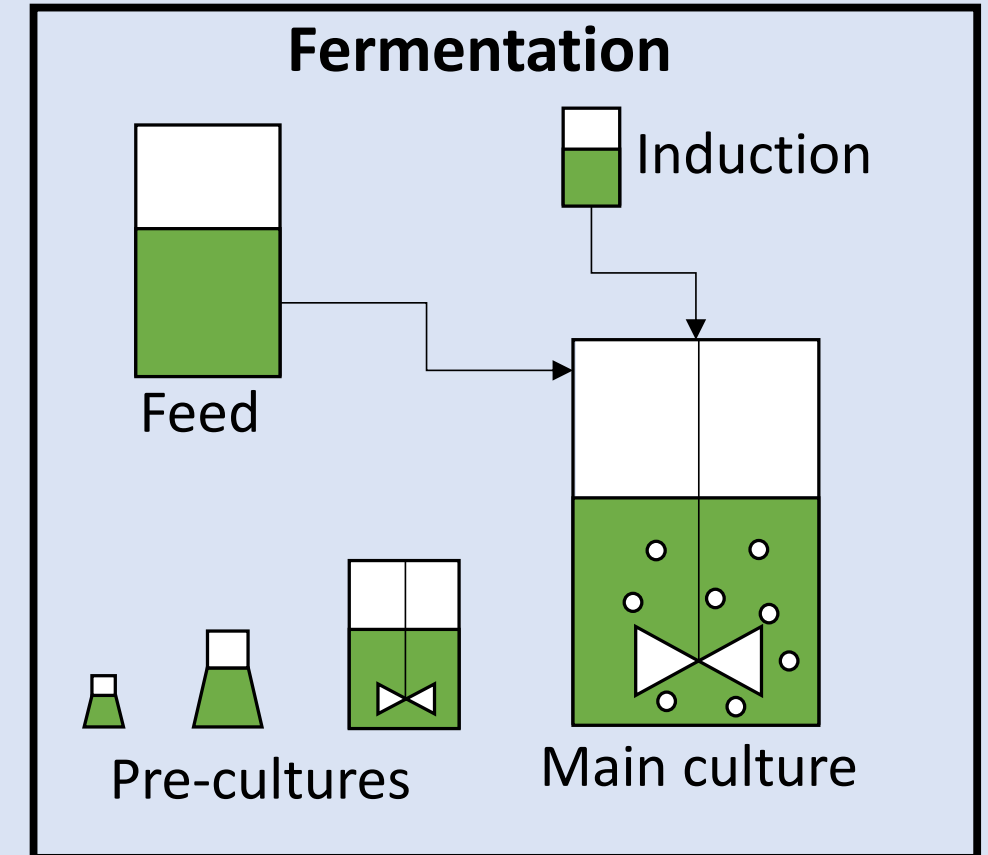


### Fireblight: *E. amylovora* infection assays on apple tree flowers and apple tree plantlets



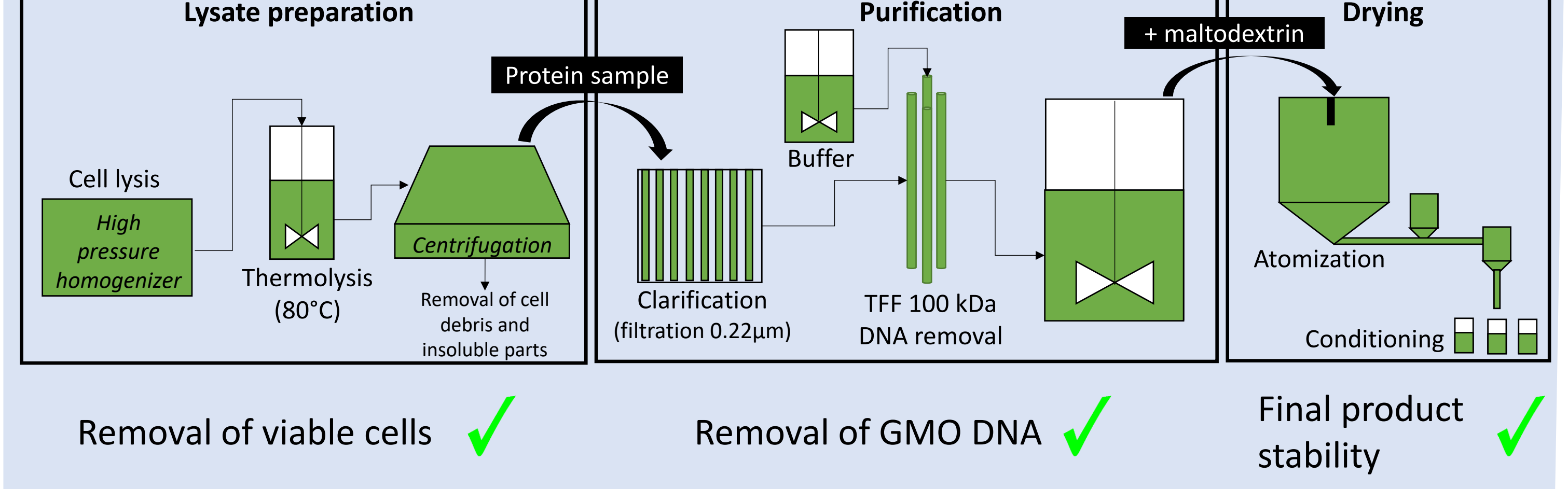
## INDUSTRIALIZATION

### Upstream Process



- Heterologous expression in *E. coli* ✓
- Production in 17L fermentor ✓
- Production in 150L fermentor (end of the year)

### Downstream Process



- Removal of viable cells ✓
- Removal of GMO DNA ✓
- Final product stability ✓

## VARIOUS APPLICATIONS

- Agriculture**: Soft rot, bacterial canker, fireblight, hairy root disease...
- Feed**: Lactonase treatment increases shrimp survival to *Vibrio parahaemolyticus* challenge.
- Water treatment**: Industrial cooling towers using immobilized lactonases
- Cleaning/cleansing**: Anti-biofilm properties
- Aquaculture**: Microbiome modulation in poultry

**VesuBACT: a sustainable enzymatic solution being industrialized for fighting bacterial diseases in agriculture**

