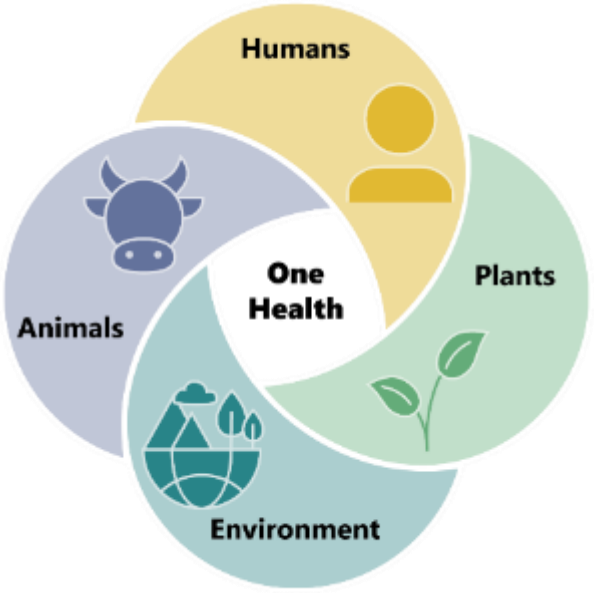
Can Scent Detection Dogs be Used for the Detection of *Erwinia amylovora* and *Cryphonectria parasitica*?



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Olfactory Detection of Plant Pathogens in Perennial Crops in Fruit Growing (PATDOG)

2023-2025

Supported by the federal government and dafne.at

Federal Ministry
Agriculture and Forestry, Climate
and Environmental Protection,
Regions and Water Management
Republic of Austria

DaFNE

Research questions

- How can dogs, especially those without prior training, be trained to recognize plant pathogens in symptomatic and asymptomatic plants with high sensitivity and specificity ?
- How well can dogs distinguish the target pathogens from empty media as well as from other fungal / bacterial cultures, and what role does the concentration of the pathogens play?
- Can dogs trained with fungal /bacterial cultures also recognize inoculated trees, and if so, how reliably can the dogs identify the inoculated trees?
- Is there a risk that dogs working with inoculated trees might contribute to the spread of the pathogens?

A fungal and a bacterial pathogen were selected as representative model organisms for the study

E. amylovora (fire blight)

C. parasitica (chestnut blight)

Dog selection

operational teams of

- Shelter dogs (15) + their caregivers
  - testing their environmental suitability
  - initiative of the dogs

- previously trained detection dogs (5) + their handlers

All dogs were trained under the guidance of a professional dog trainer

Multi-stage training

- dogs were conditioned to the Detection Dog Training System (DDTS)
- Equip DDTS with cultures of the pathogens
- Line-up with cultures in containers
- Line up with (± inoculated) young trees
- Training with higher trees
- Training in orchards

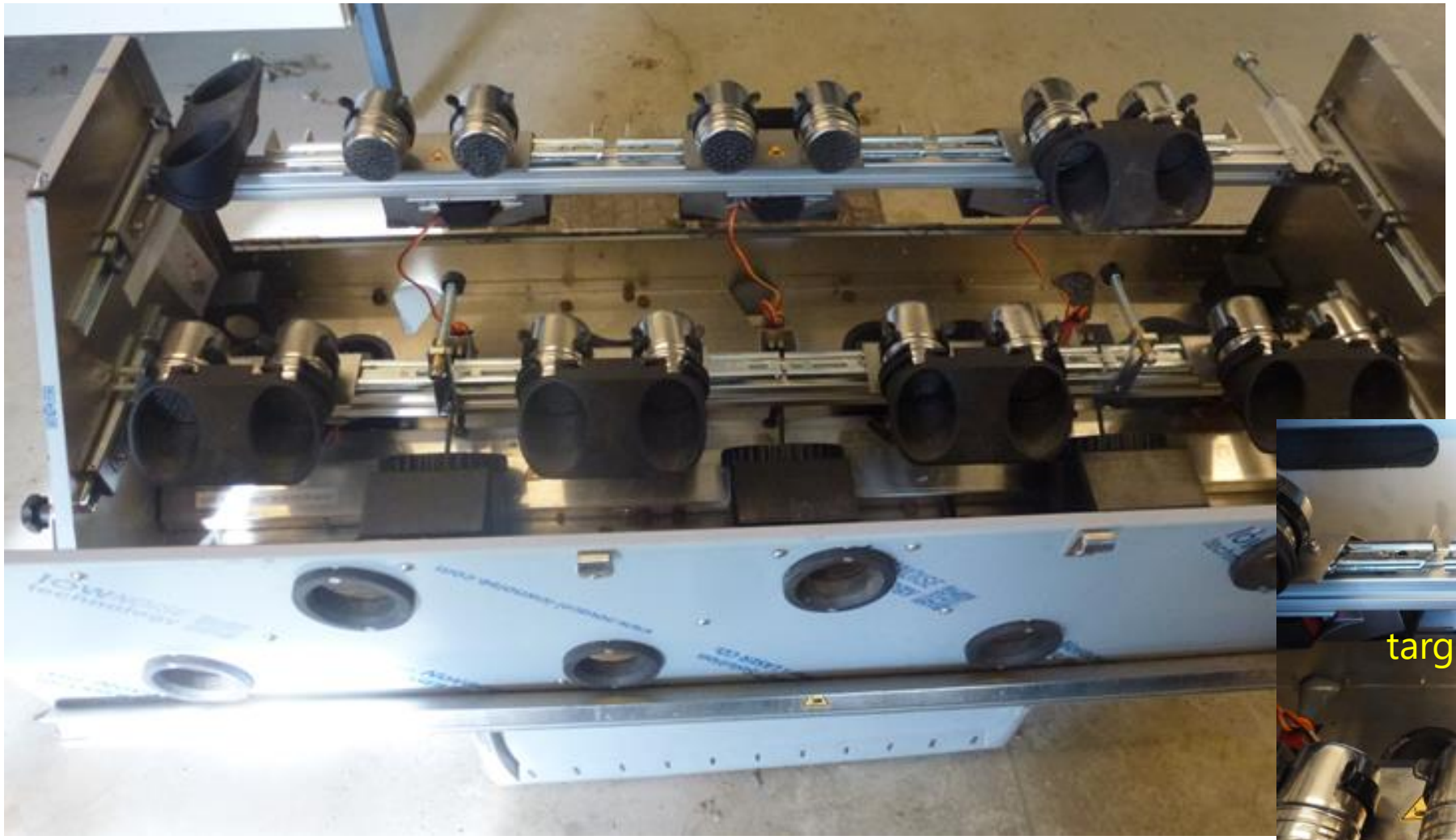
DDTS

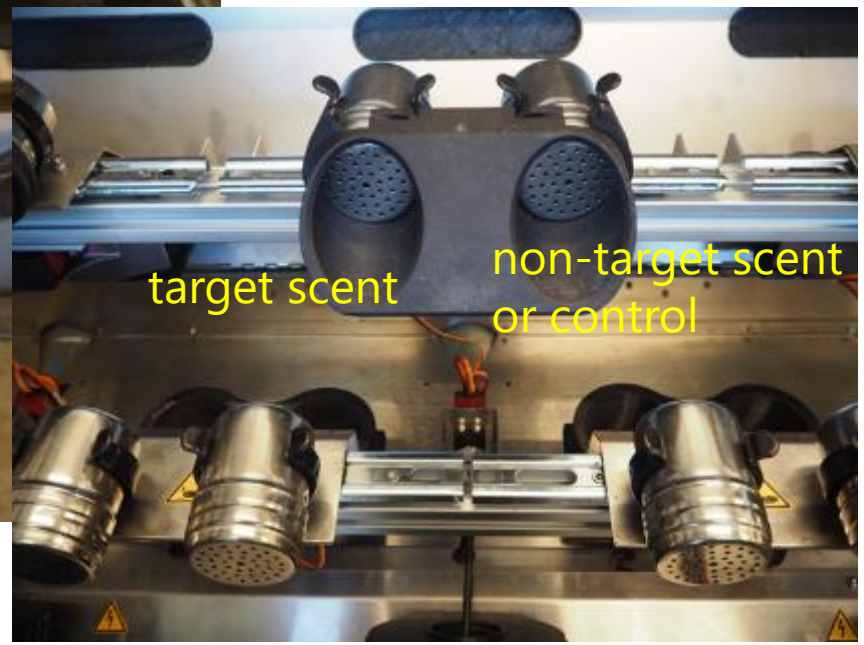
Electronic device for training dogs in scent conditioning, scent differentiation, and scent indication

Advantages:

- The human factor does not influence the result, no intervention by the handler
- Fully automated training system
- Scents are allocated randomly
- Automatic reward
- Good reproducibility
- Wide selection of parameters for data collection
- Generates test protocols
- Controlled via tablet

DDTS



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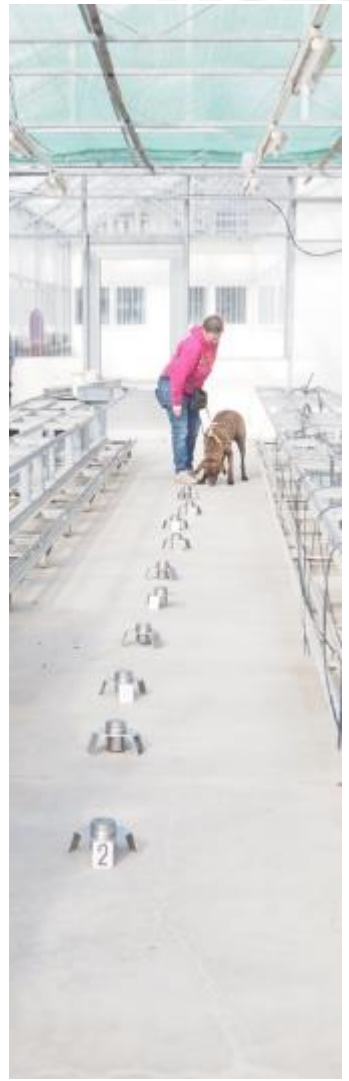
Evaluation of the effectiveness of the learning method

Line up with containers

10 containers with perforated lids

1- 2 filled with target scent + 8-9 containers with non-target scent or control

Task: dogs had to indicate all samples with target scent and ignore other sample types

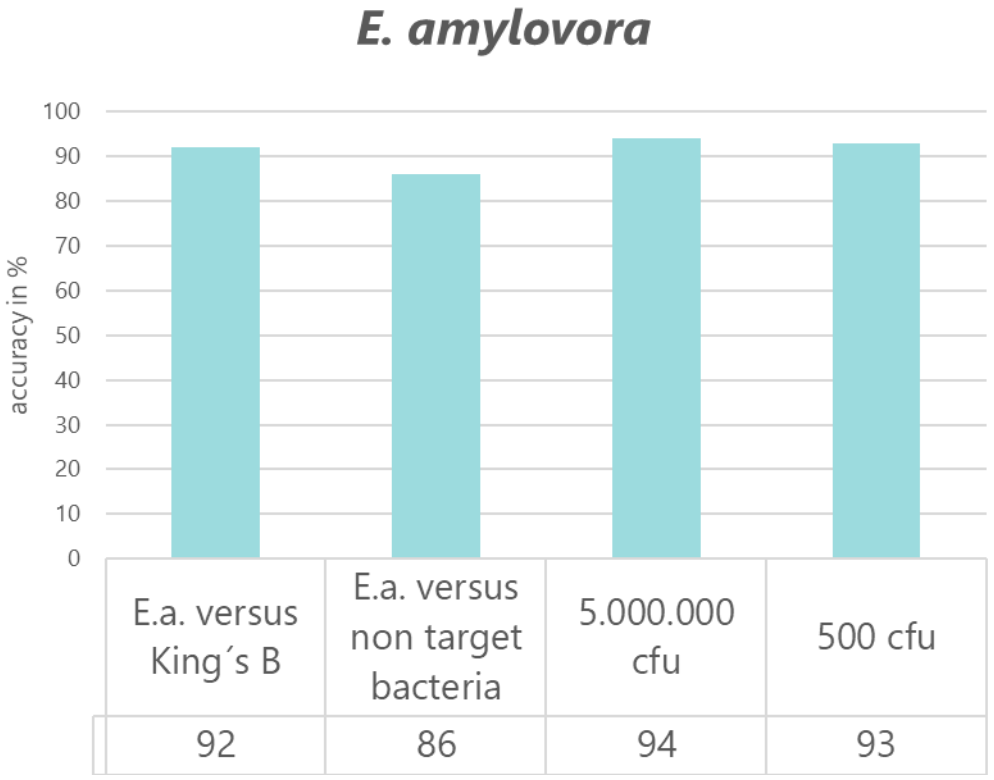


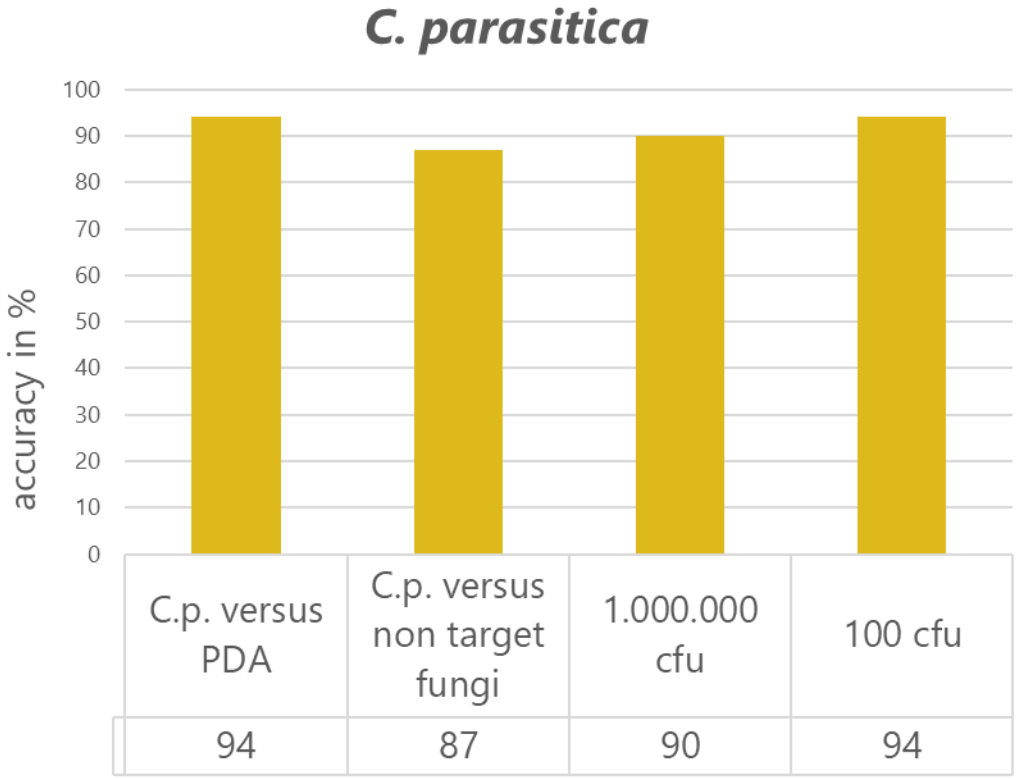
Scents / pure cultures

target scent	non-target scent	culture media	control
Erwinia amylovora	*E. tasmaniensis* *E. rhapontici* *E. pyrifoliae* *Pseudomonas syringae* pv. *syringae*	King´s B Medium	uninoculated culture media
Cryphonectria parasitica	*Phytophthora cambivora* *Gnomoniopsis castaneae*	PDA	uninoculated culture media

Results

Accuracy for the detection of the target scents (DDTS)



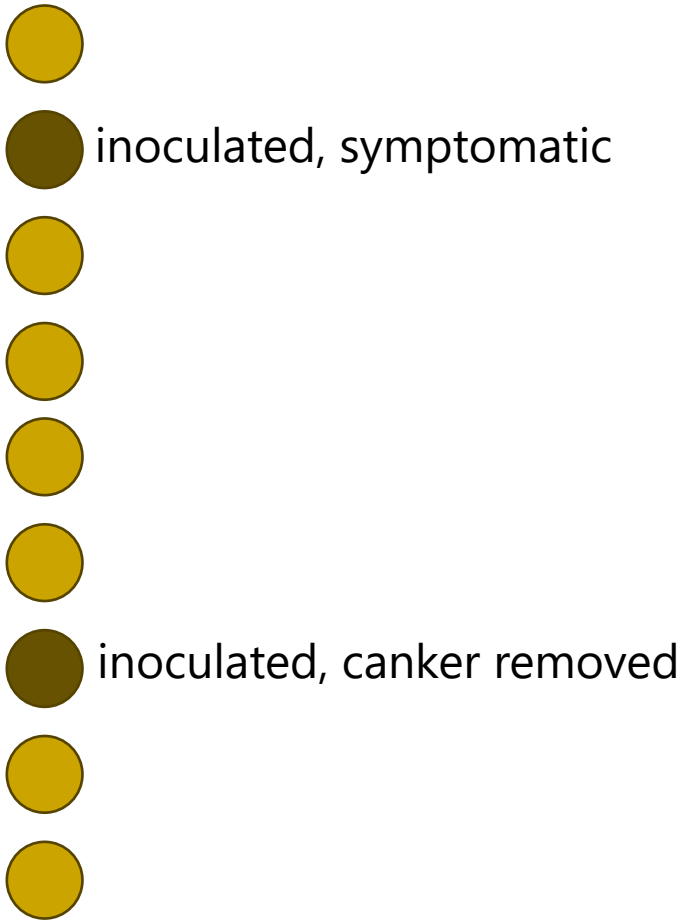


Detection of the target scent in inoculated trees

- 9 trees in line-up
- distance 1,5 – 2 m
- 2 inoculated trees per line-up (randomly distributed)

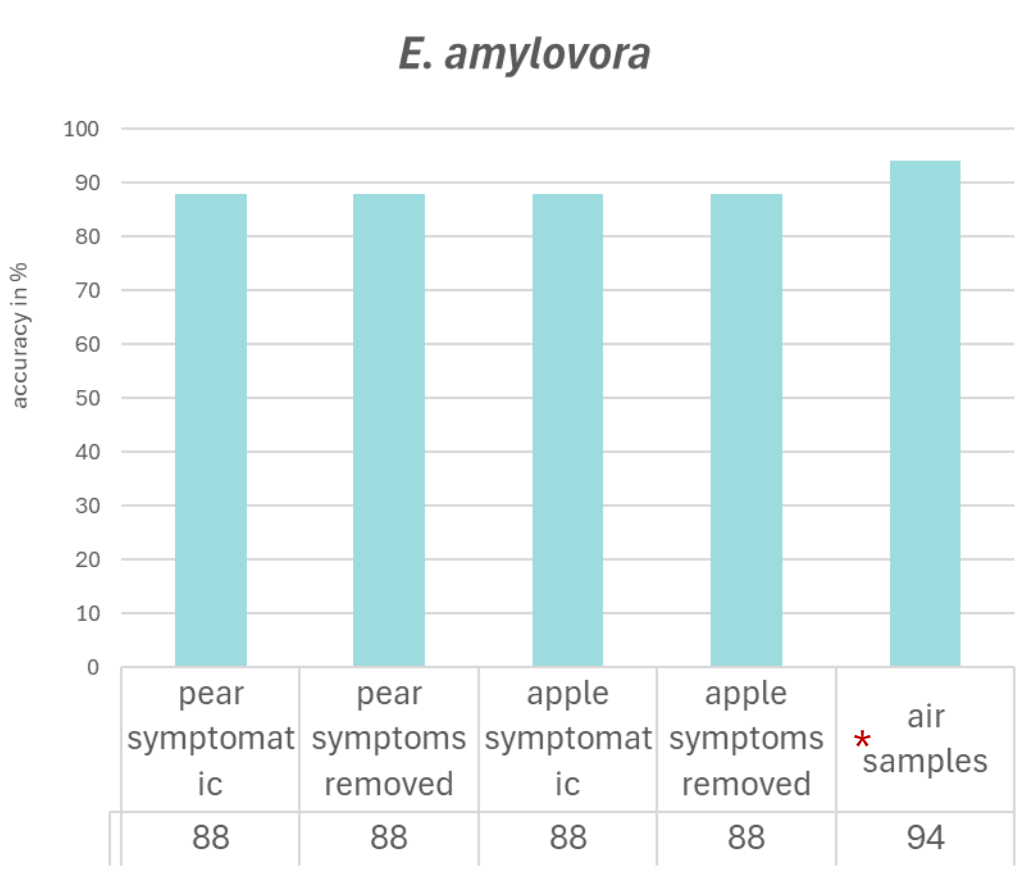
E. amylovora

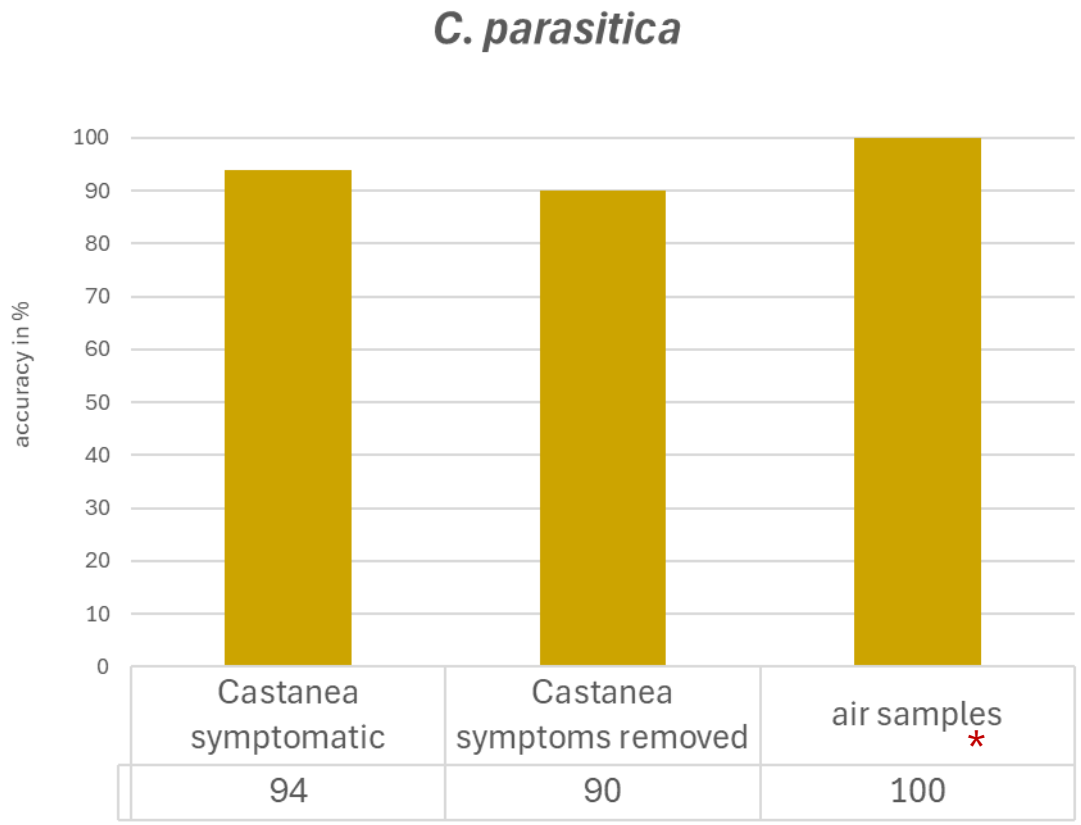
C. parasitica



Results

Line up with inoculated trees + air samples





* The surrounding air of the small trees was sampled by suction for 10 seconds

Summary

- The selected pathogens can be detected in both symptomatic and asymptomatic plants with high sensitivity and specificity.
- All dogs are capable of learning to detect the selected pathogens, but training under realistic field conditions is essential.
- There is no evidence of pathogen transmission by the detection dogs.
- Pre-screening in orchard environments (with vacuum cleaner) is feasible.

Thanks to all project team members !!

L. Slotta-Bachmayr, R. Gottsberger, J. Reiterer, C. Lippitz, E. Lehner; caregivers of shelter dogs











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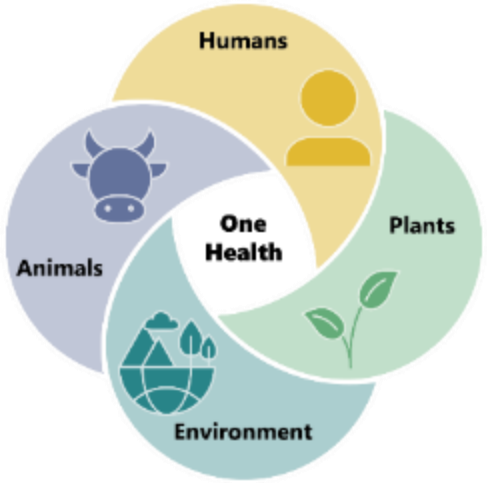

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