Pathogenicity of *Alternaria*-species on potatoes and tomatoes

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BASF
The Chemical Company

Fungal species associated with Early Blight

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- *Alternaria solani*
- *Alternaria tomatophila*
- *Alternaria grandis*

Large spored species

- *Alternaria alternata*
- *Alternaria tenuissima*
- *Alternaria arborescens*
- *Alternaria infectoria*

Small spored species

Fungal species associated with Early Blight

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- ***Alternaria solani***
- *Alternaria tomatophila*
- *Alternaria grandis*

Large spored species

- ***Alternaria alternata***
- *Alternaria tenuissima*
- *Alternaria arborescens*
- *Alternaria infectoria*

Small spored species

→ **In this presentation *A. solani* stands for large spored, *A. alternata* small spored species**

Early Blight on potatoes
Symptoms

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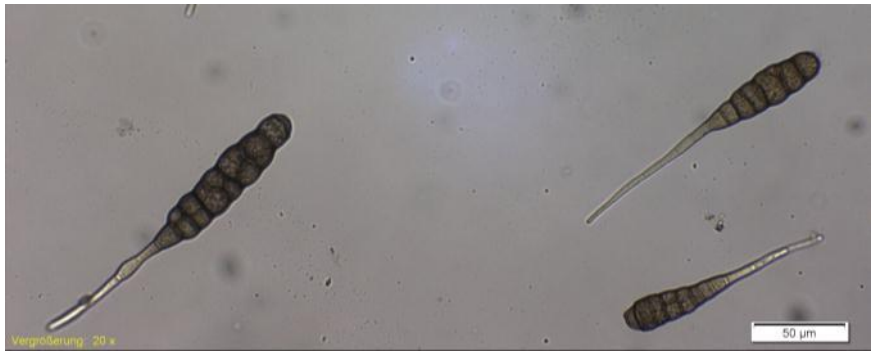
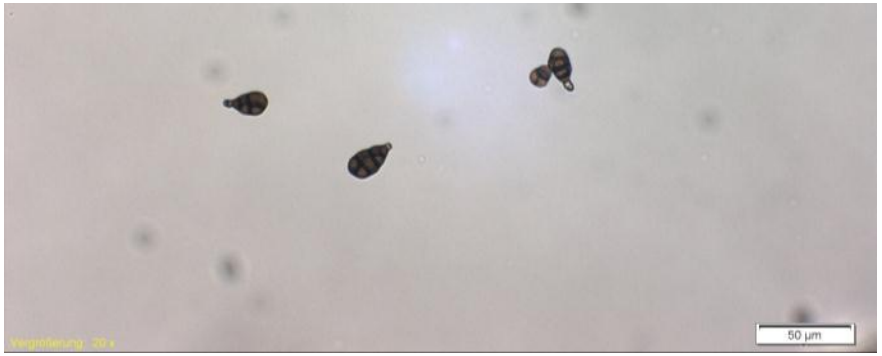
In Europe mainly *A. solani* and *A. alternata* are isolated from diseased leaves

- Collection of 22 potato leaf samples in 2011 yielded in

225 isolates of *Alternaria solani*



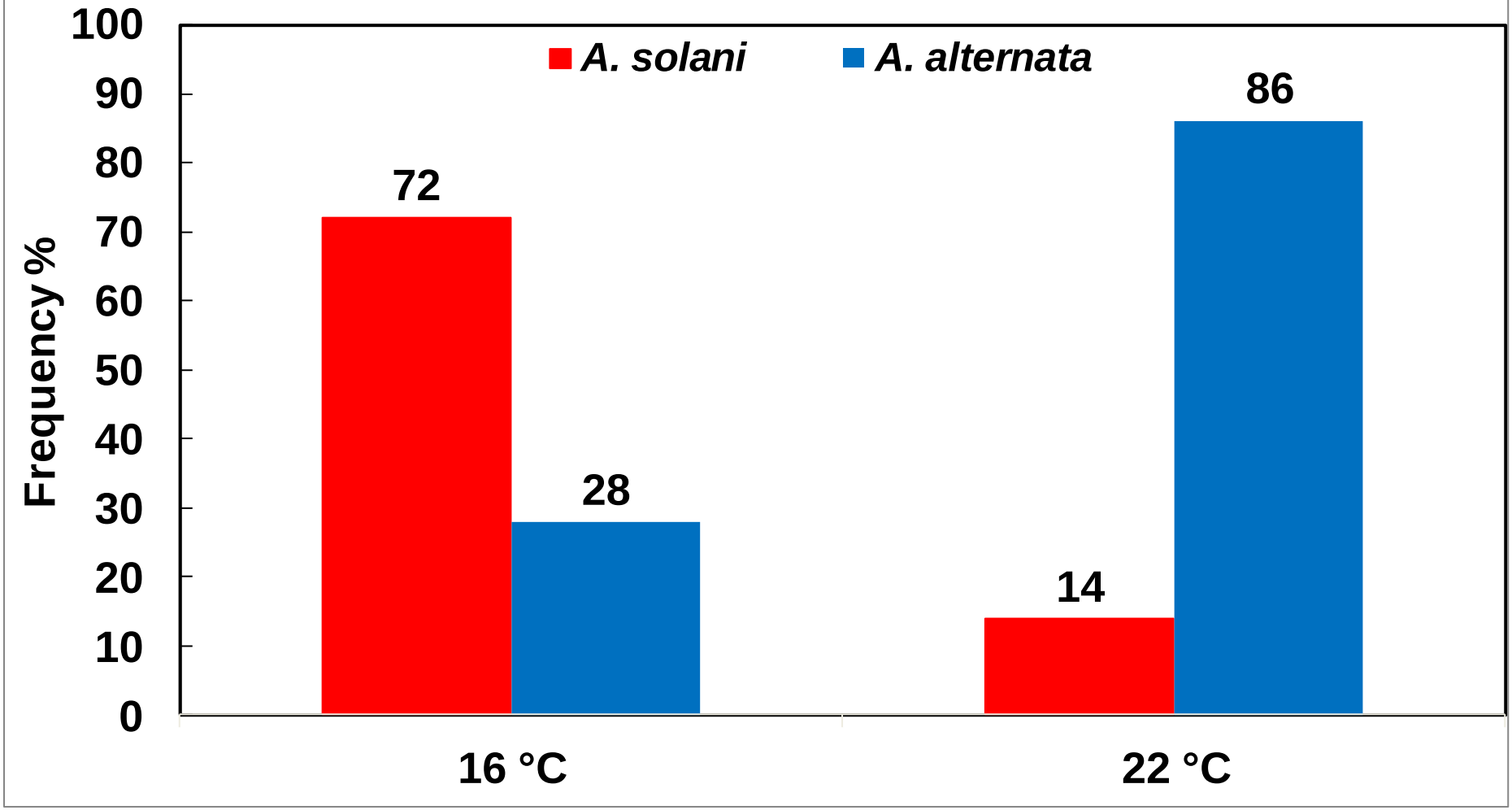
307 isolates of *Alternaria alternata*



Low temperatures during isolation process increases frequency of *A. solani*, high *A. alternata*

10 samples, 161 isolates analysed

16 C and 22 C at incubation of leaves in moist chamber before isolation



Isolates used in the infection studies were from different sources

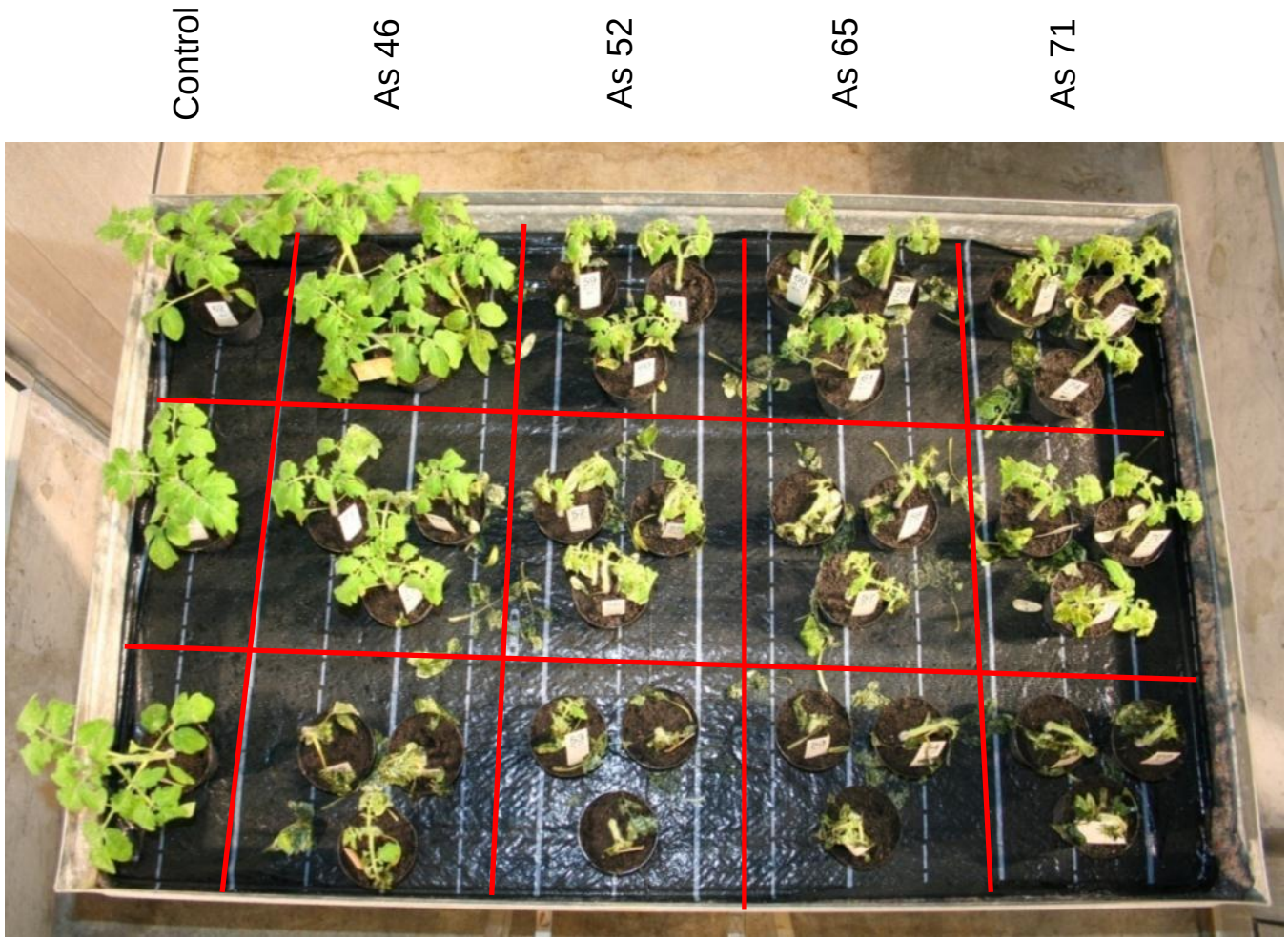
- *A. alternata*:
  - 4xUS, 1xNL, 2xBE, 2xPL, 11xDE
- *A. solani*:
  - 5xUS, 2xFR, 1xDE, 2xNL, 1xUK
- All from potato

Pathogenicity of *A. alternata* and *A. solani* on tomatoes

- **Isolates from different origins used**
- **Different spore suspensions (medium, spore conc.)**
- **Variation in inoculation conditions**
- **Different nutrition of tomato plants**
- **Variation of inoculation time point (growth stages)**
- **Tomato variety: Goldene Königin**

Pathogenicity of *Alternaria solani* on tomatoes

Greenhouse, 6 dpi

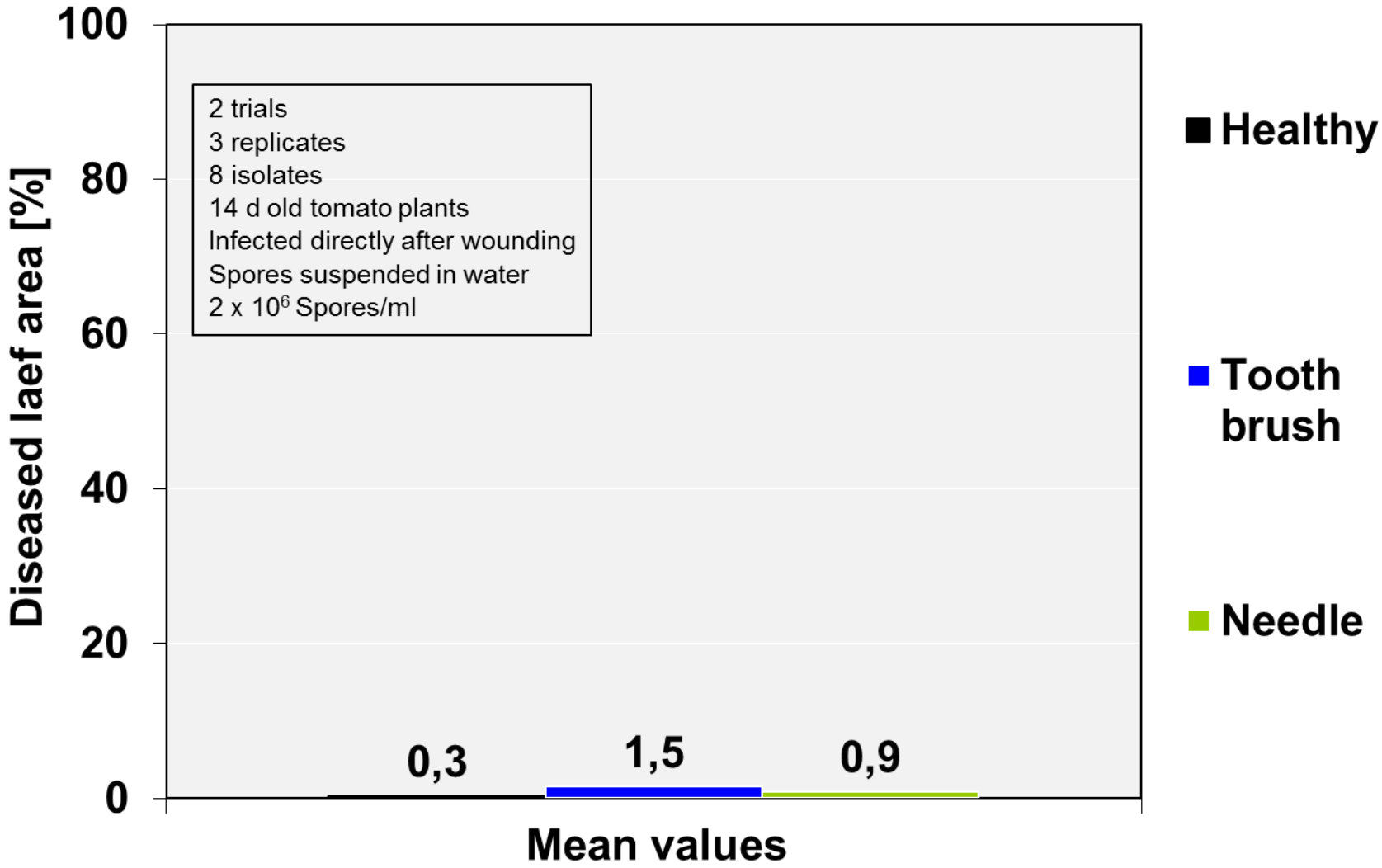


Pathogenicity of *Alternaria alternata* on tomatoes

Greenhouse, 6 dpi

Alternaria alternata did not infect healthy, weak or strong wounded tomato leaves

2 trials, 8 isolates, evaluation 9 dpi



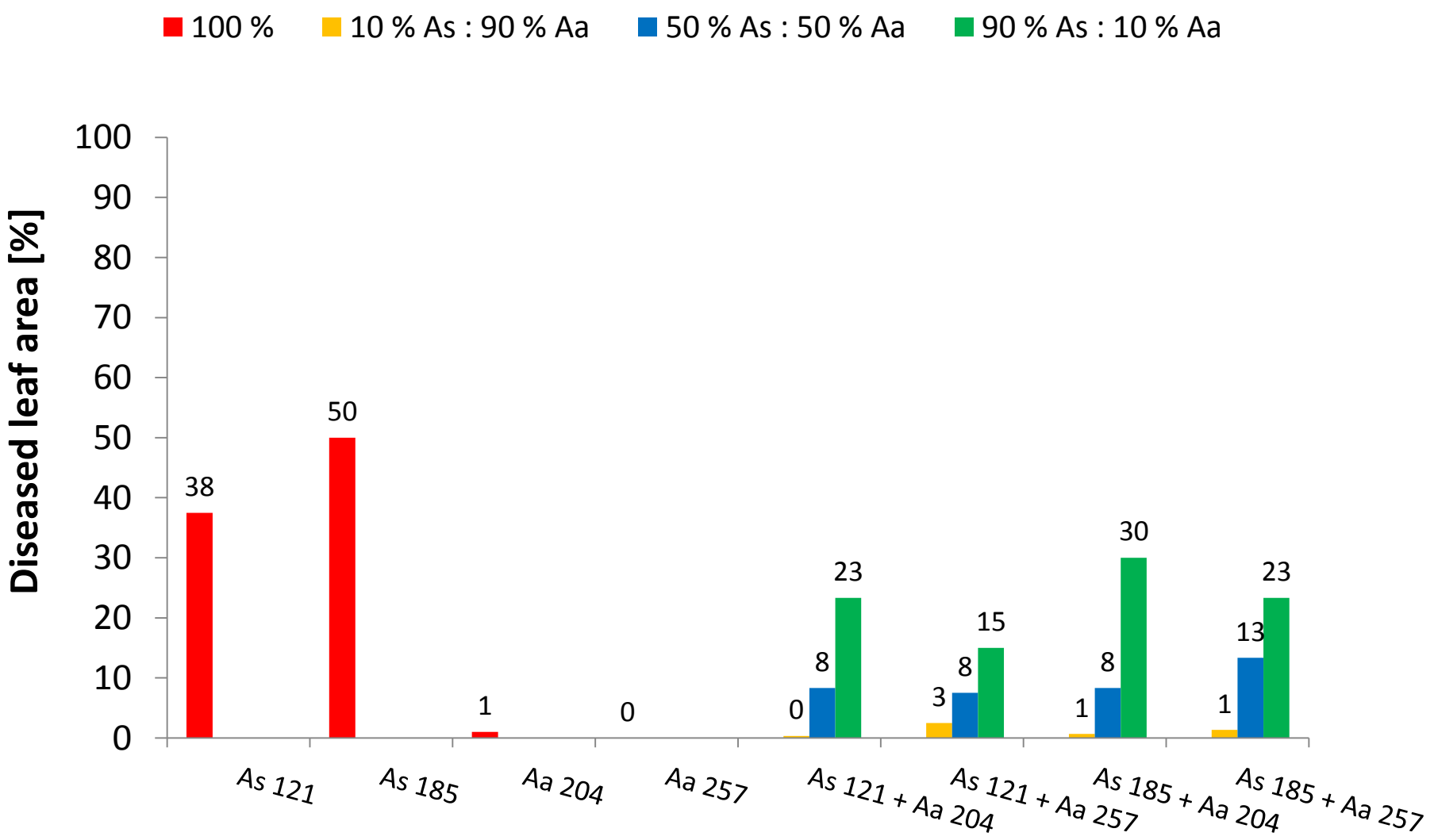
In vivo greenhouse experiments – different isolates alone and in mixture

- 2 *A. solani isolates*: As 121, As 185
- 2 *A. alternata isolates*: Aa 204, Aa 257
- Spore suspension made with water or 2 % malt solution
- Tomato plants 3 weeks old
- Mixture in different ratios
  - 100%
  - 10 % *A. solani* : 90 % *A. alternata*
  - 50 % *A. solani* : 50 % *A. alternata*
  - 90 % *A. solani* : 10 % *A. alternata*

Mixtures for simulation of pathogen complex

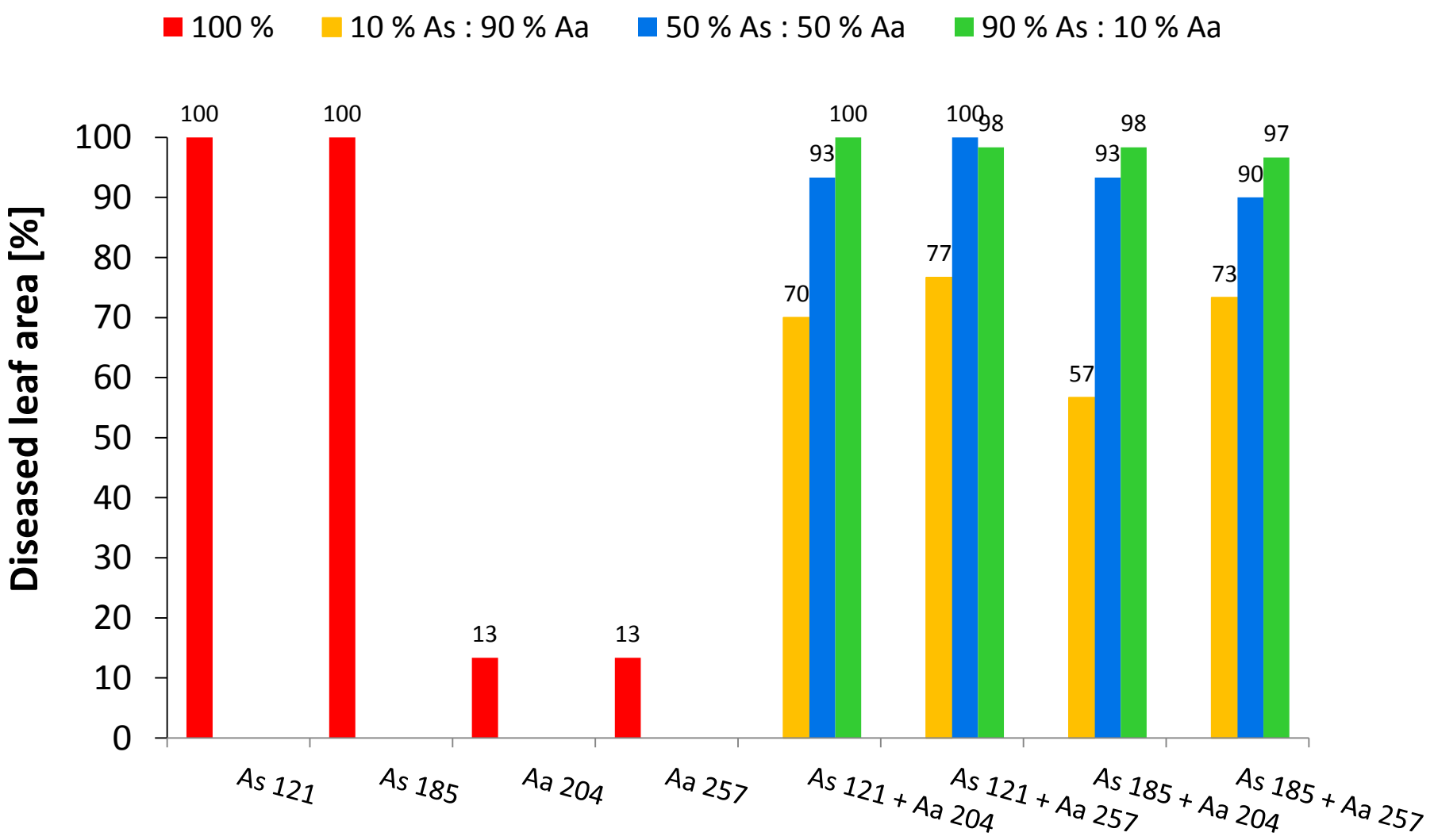
Infection trials with solo and mixtured inoculum

4 dpi, spore suspension in deionized water



Infection trials with solo and mixtured inoculum

4 dpi, spore suspension in 2 % malt solution



Infection trial with older plants

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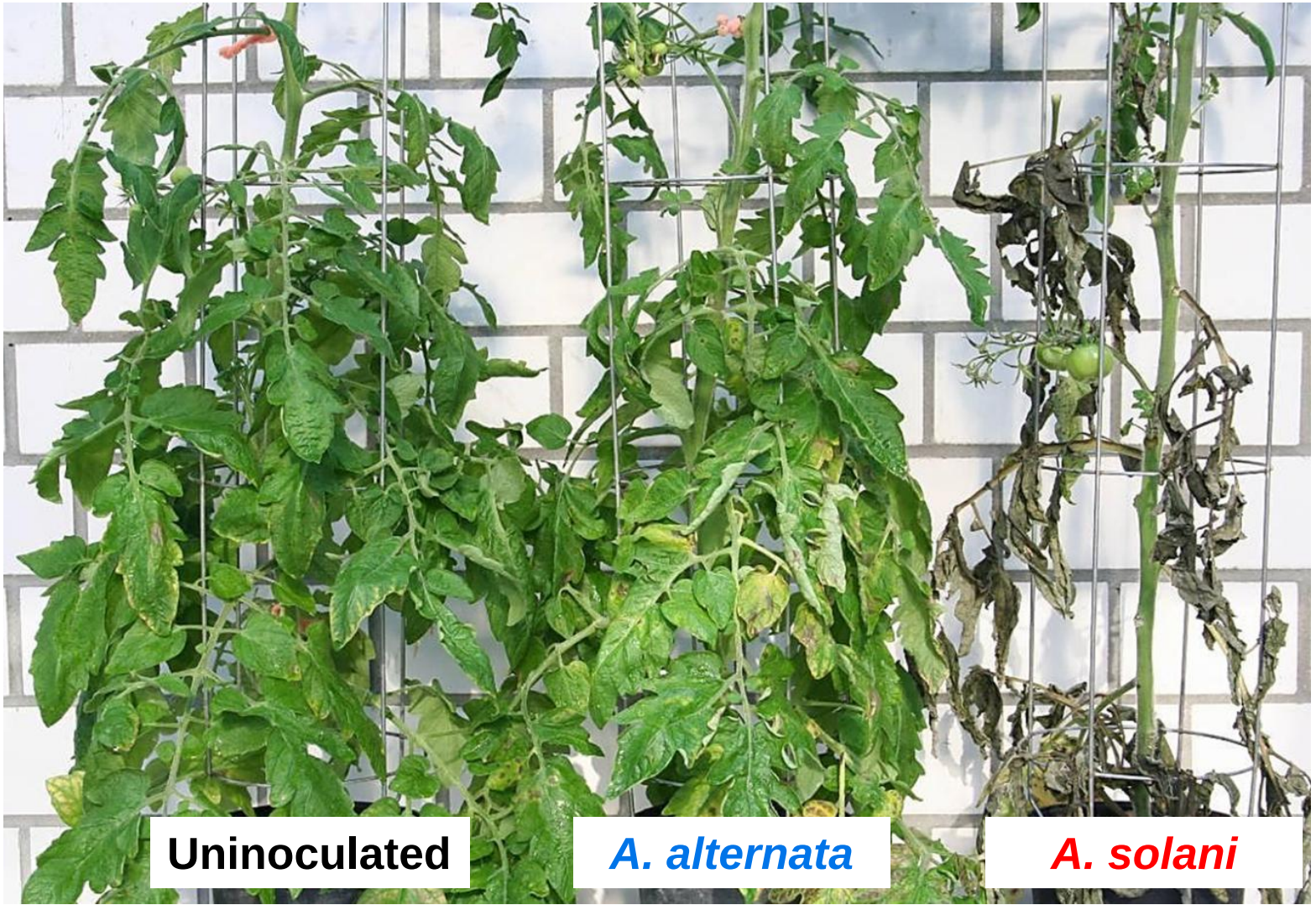
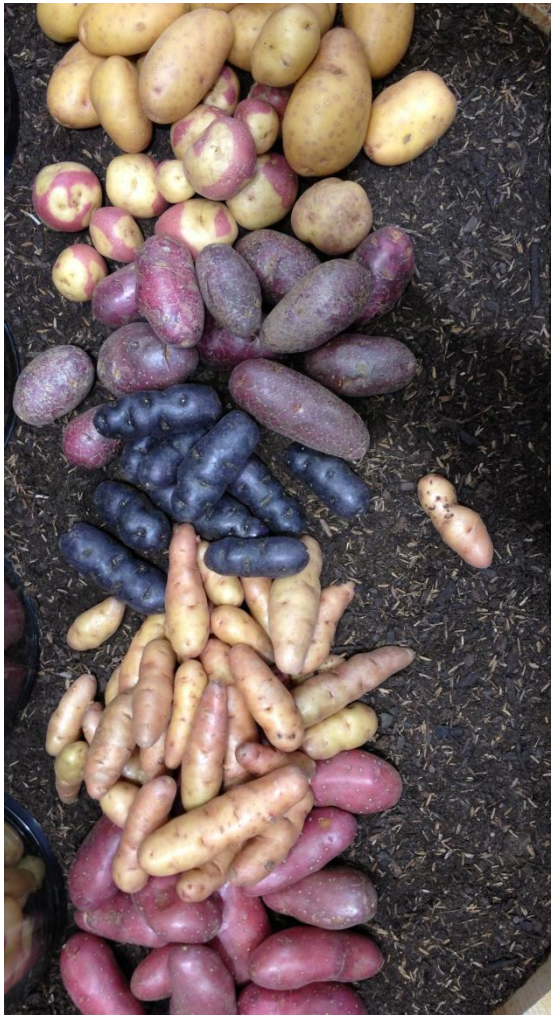
7 dpi, spore suspension in 2 % malt solution, 2 months old plants



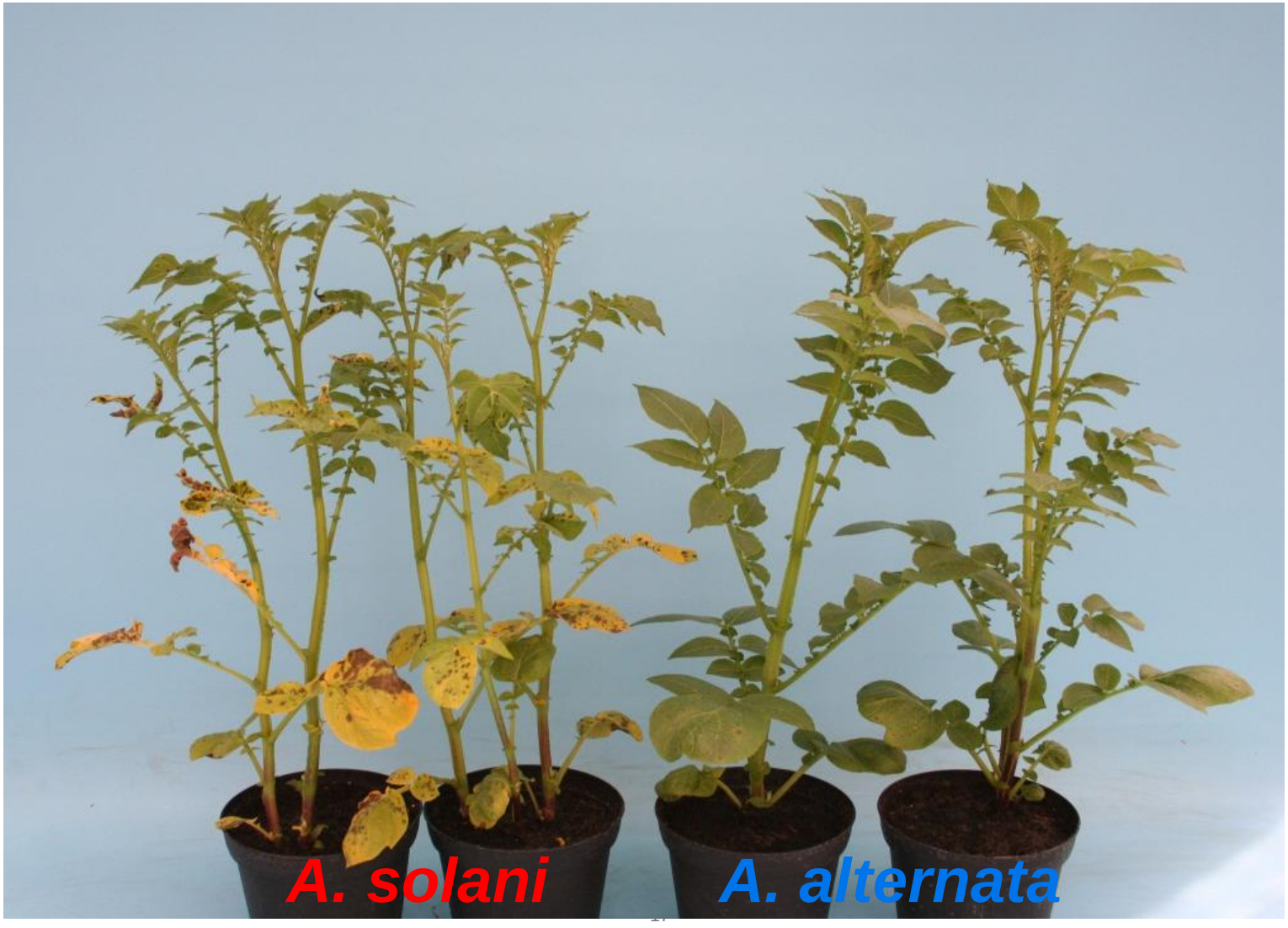
Pathogenicity of *A. alternata* and *A. solani* on potatoes

- **Greenhouse:**
  - **Isolates from different origins**
  - **Various potato varieties**
  - **Different spore suspensions**
  - **Variation in inoculation conditions**
  - **Different nutrition of potato plants**



Infection on potted potatoes

Greenhouse trial, variety Kuras



Infection on potted potatoes

Greenhouse trial, variety Aveka

Field trials

- **Trial question**
  - Can *A. alternata* infect potatoes under field conditions?
  - Is the pathogen complex (*A. solani* + *A. alternata*) more virulent than *A. solani* and how does *A. alternata* develop in a mixed infection?
- **Trial layout**
  - 4 trials
    - 2 varieties: Kuras and Aveka
    - 2 inoculation time points
  - Inoculation with 2 strains of *A. solani* and 2 strains of *A. alternata*
  - Strains solo and in different mixtures with defined ratios
- **Evaluation**
  - % diseased leaf area
  - Ratio *A. solani* and *A. alternata*

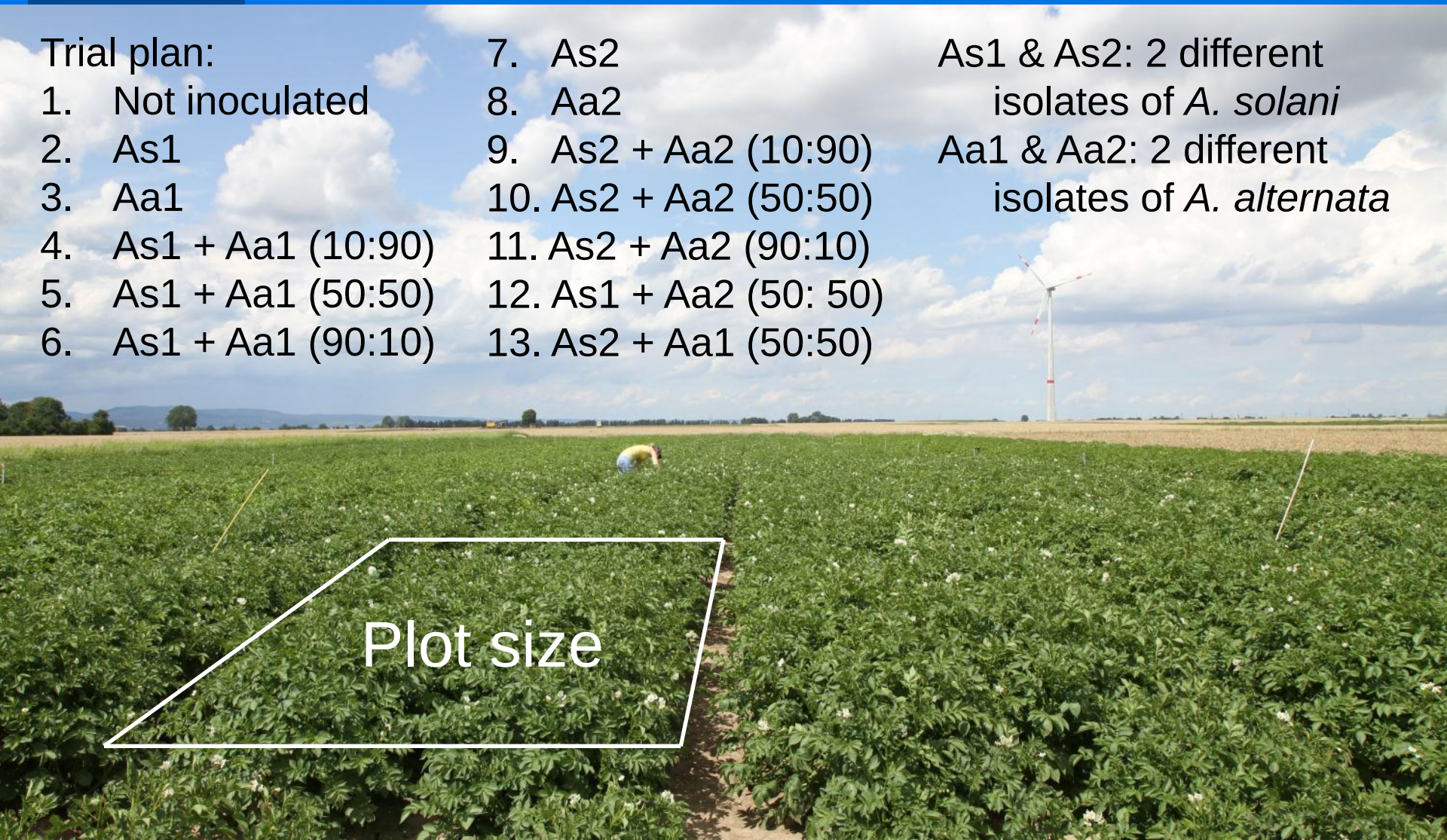
Field trials

Trial plan:

1. Not inoculated
2. As1
3. Aa1
4. As1 + Aa1 (10:90)
5. As1 + Aa1 (50:50)
6. As1 + Aa1 (90:10)
7. As2
8. Aa2
9. As2 + Aa2 (10:90)
10. As2 + Aa2 (50:50)
11. As2 + Aa2 (90:10)
12. As1 + Aa2 (50: 50)
13. As2 + Aa1 (50:50)

As1 & As2: 2 different isolates of *A. solani*

Aa1 & Aa2: 2 different isolates of *A. alternata*



Field trials

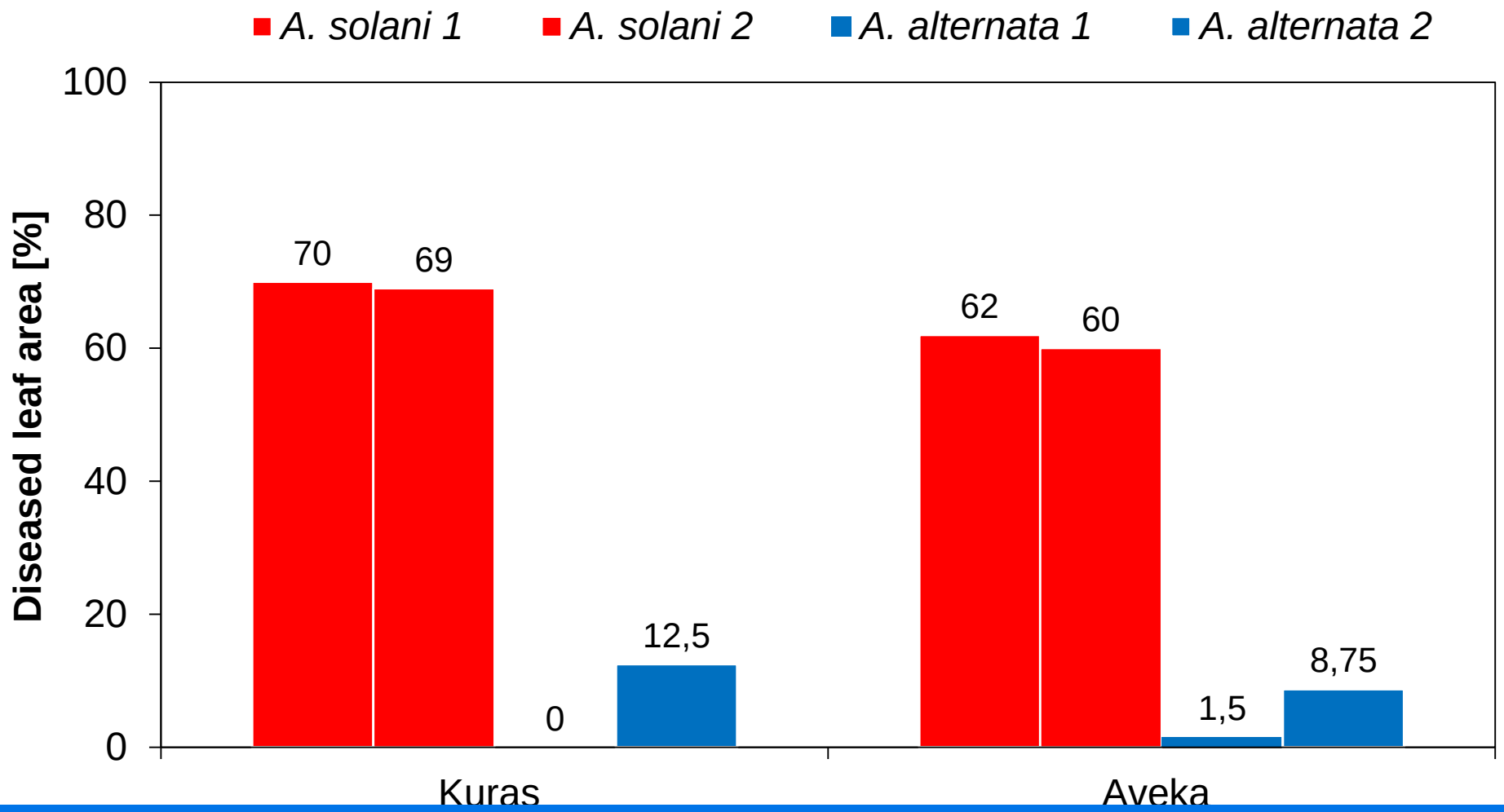
First symptoms after 4 days in *A. solani* plots

Field trials

High disease level after 3 weeks in *A. solani* plots

Field trials 2012

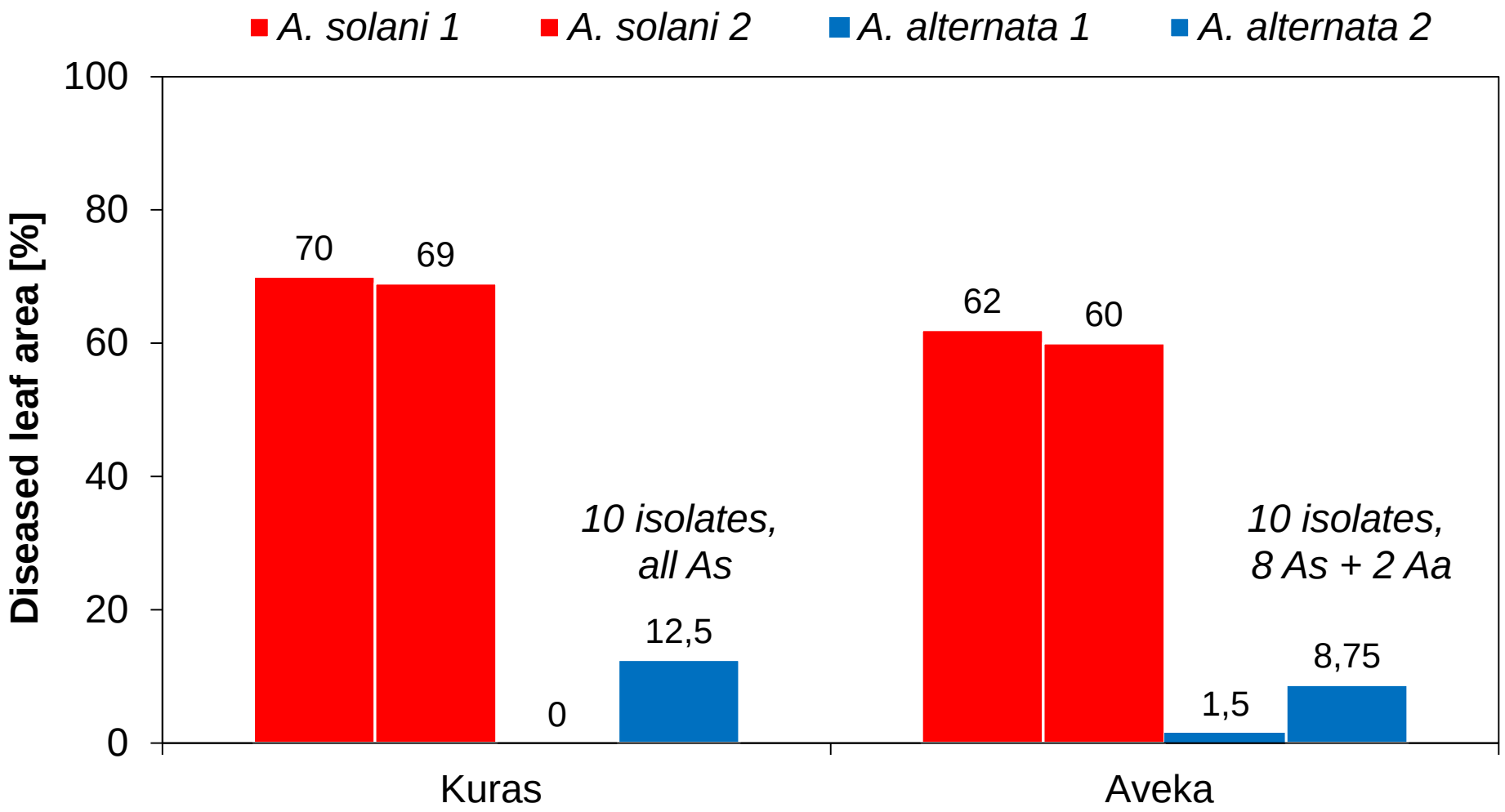
Potatoes, varieties: Kuras, Aveka
2 strains *A. solani*, 2 strains *A. alternata*
Inoculation: 14.06.2012
Evaluation: 06.07.2012



→ **only *A. solani* caused severe disease**

Field trials 2012

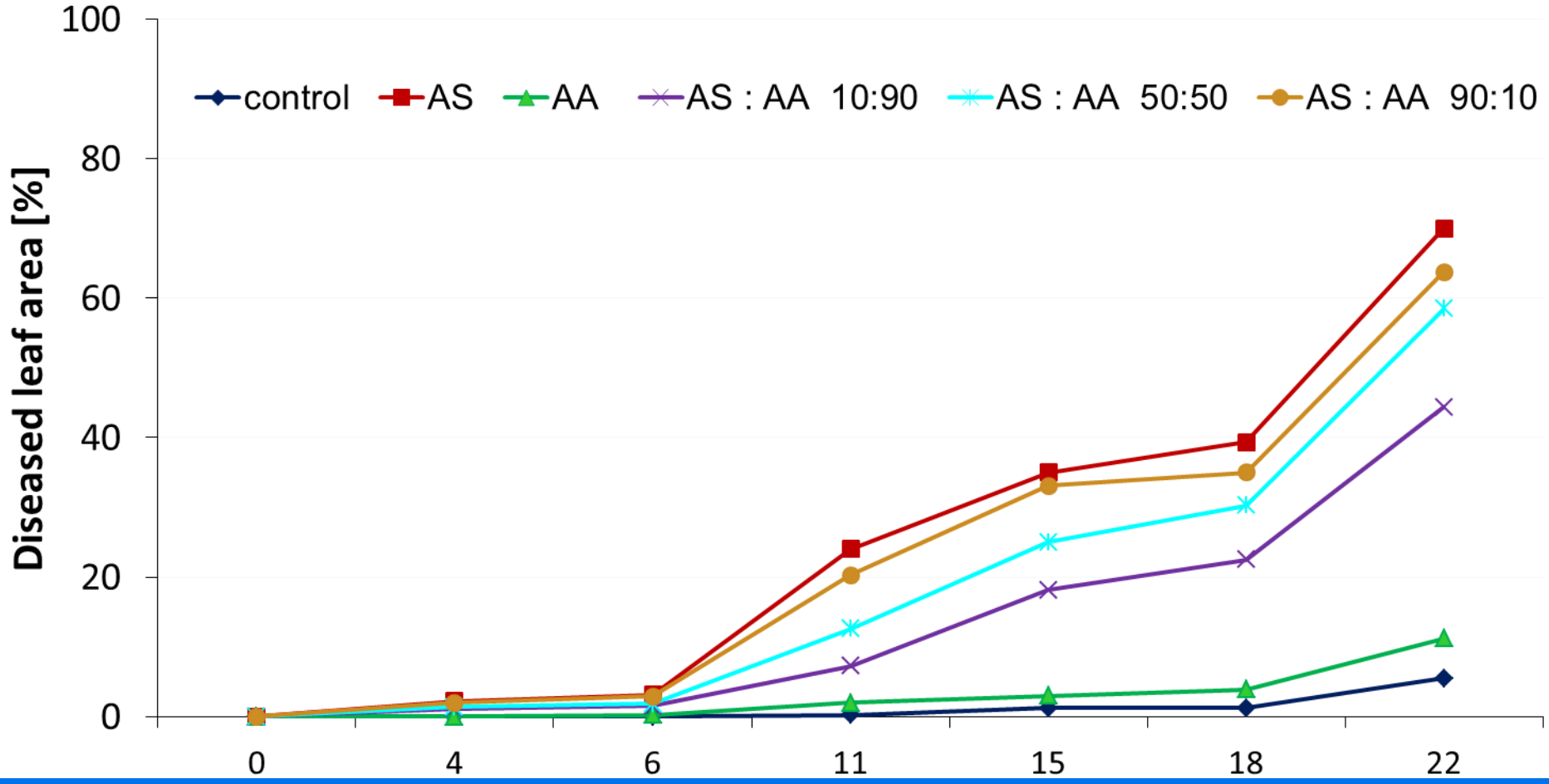
Potatoes, varieties: Kuras, Aveka
2 strains *A. solani*, 2 strains *A. alternata*
Inoculation: 14.06.2012
Evaluation: 06.07.2012



Field trials 2012

Progress of disease in different plots

→ only *A. solani* containing spore suspensions caused severe disease



→ Disease severity depends on quantity of *A. solani*. *A. alternata* does not enhance disease and is decreasing during disease progress (qPCR)

Summary

- *A. solani* and *A. alternata* are present on leaves with typical symptoms
- Temperature during isolation process plays a significant role which species will be isolated
- *A. solani* is highly, *A. alternata* is not or very low virulent in the greenhouse
- Wounding did not increase disease levels of *A. alternata* in tomatoes
- *A. solani* is highly, *A. alternata* is not or very low virulent on potatoes in the field


Thank you for your attention!