

# Kiwifruit bacterial canker: Novel insights on an old problem

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## Framework

Kiwifruit bacterial canker (KBC), caused by *Pseudomonas syringae* pv. *actinidiae* (PSA), is currently the most destructive disease of kiwifruit worldwide. It was introduced in Portugal in 2010, inducing production losses up to 80 %. Conversely, a closely related pathovar, *P. syringae* pv. *actinidifoliorum* (PSAF), only causes necrotic spots, not being associated with plant mortality. There is some evidence on the higher susceptibility of green kiwifruit (*Actinidia deliciosa*) cultivars to KBC, compared with the berry kiwi (*A. arguta*), but the reasons behind it are still largely unknown. The aim of this work was to evaluate how kiwi plants with reported distinct tolerance to the disease responded to artificial infection in terms of defence-related genes expression.

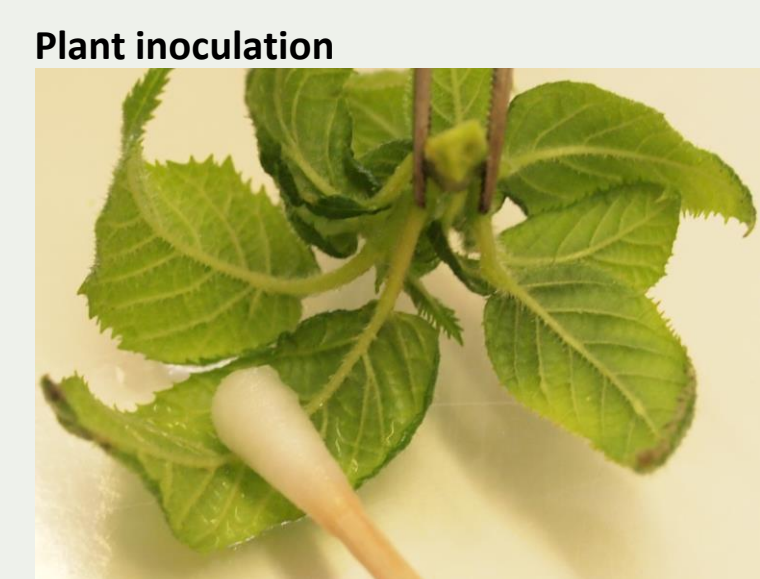
## Methods

1) Micropropagation of *A. deliciosa* cv. 'Hayward' and *A. arguta* cv. 'Ken's Red' plants.

2) Plant inoculation with a virulent *Pseudomonas syringae* pv. *actinidiae* strain (PSA) and with a low virulent *P. syringae* pv. *actinidifoliorum* strain (PSAF).

3) Bacterial colony forming units (CFUs) determination in plant tissues 1, 2 and 5 days post inoculation (dpi).

4) Defence-related gene expression analysis by reverse transcription polymerase chain reactions (qRT-PCR) at 1, 2 and 5 dpi.



## Results & Discussion

### DISEASE SYMPTOMS

Leaf browning was only observed 5 dpi in PSA inoculated 'Hayward' plants, demonstrating the high virulence of this bacterial strain and the lower tolerance of this cultivar, compared with 'Ken's Red'



Figure 1. 'Hayward' plant 5 days after inoculation with PSA.

### ANTIOXIDANT ENZYMES

SOD expression was drastically increased in 'Hayward' (up to 1.1-fold), whereas in 'Ken's Red' CAT was the most upregulated gene (up to 0.7-fold), compared to controls

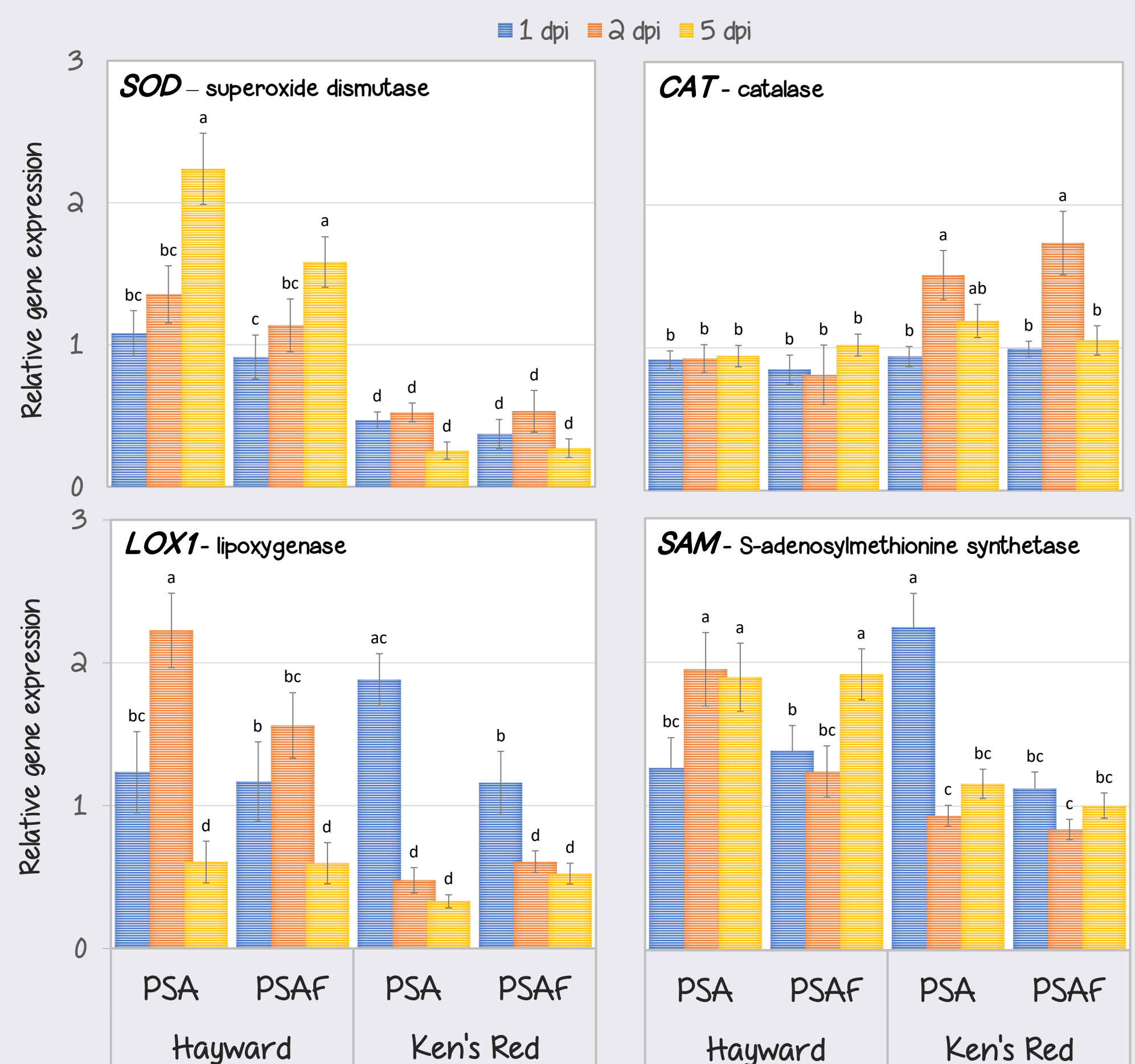


Figure 3. Gene expression of *CAT*, *SOD*, *LOX1* and *SAM* in 'Hayward' and 'Ken's Red', 1, 2 and 5 days post inoculation (dpi). Each bar represents the mean of three replicates  $\pm$  SEM relative to the housekeeping genes *ACT* and *PP2A* and to control plants. Bars with the same letter are not statistically different at  $p < 0.05$ .

### COLONY FORMING UNITS

Bacteria CFUs were always higher in 'Hayward' than in 'Ken's Red' (up to 17.4-fold)

PSA appeared in plant tissues 2 dpi, whereas PSAF was only detected at 5 dpi

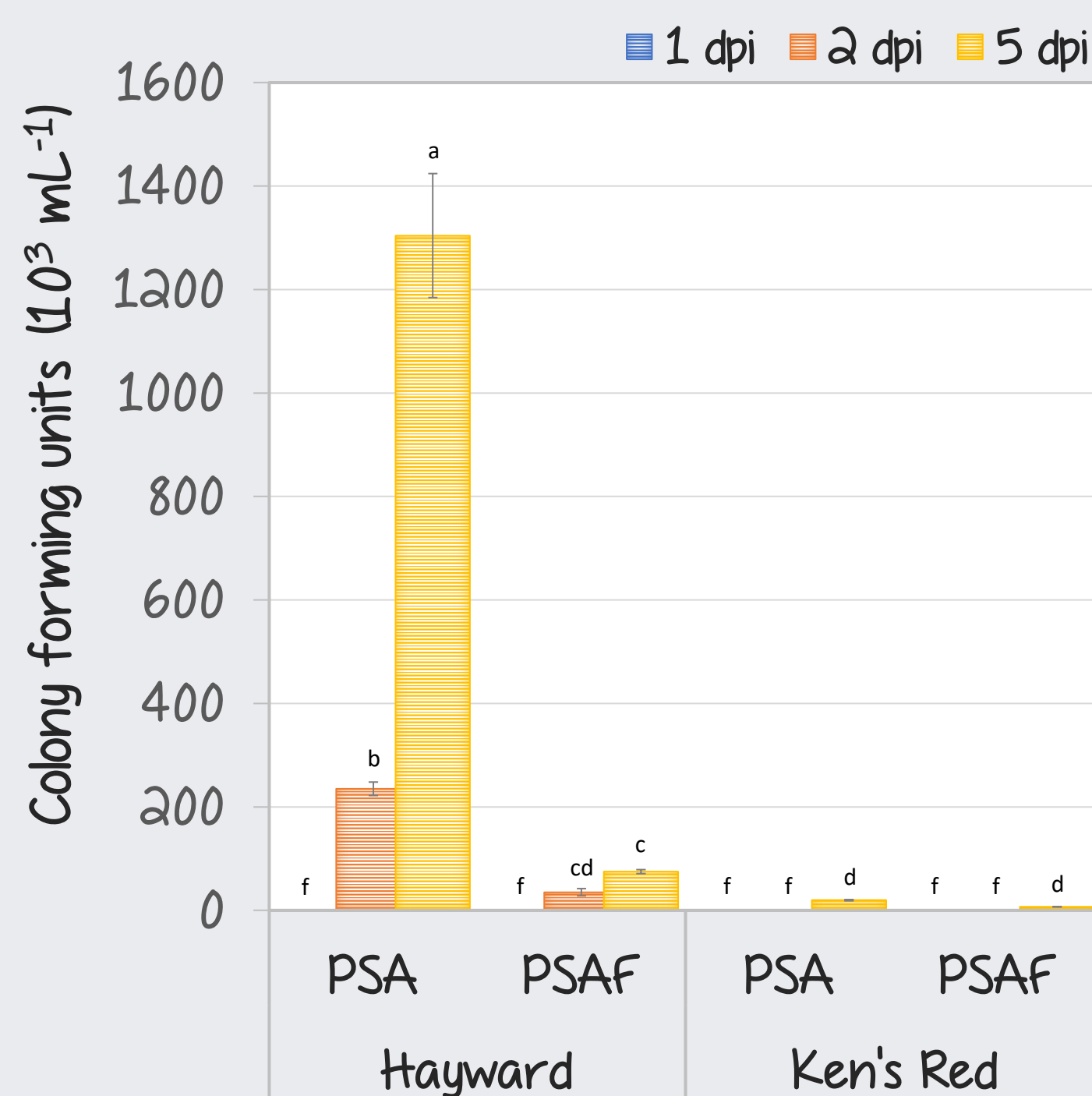


Figure 2. Number of colony forming units in 'Hayward' and 'Ken's Red', 1, 2 and 5 days post inoculation (dpi). Each bar represents the mean of three replicates  $\pm$  SEM. Bars with the same letter are not statistically different at  $p < 0.05$ .

### JASMONIC ACID PATHWAY

*LOX1* was upregulated in both species but at different time-points: up to 1.2-fold in 'Hayward' at 2 dpi and 0.9-fold in 'Ken's Red' at 1 dpi

### ETHYLENE PATHWAY

In 'Hayward' *SAM* was upregulated (0.4-fold) after inoculation with PSA and PSAF, while in 'Ken's Red' only PSA increased *SAM* expression (1.2-fold)

## Conclusions

- ✓ *A. deliciosa* cv. 'Hayward' seems to be much more susceptible to PSA infection than *A. arguta* cv. 'Ken's Red'.
- ✓ *SOD* expression was drastically increased in 'Hayward', whereas *CAT* was the most upregulated antioxidant-encoding gene in 'Ken's Red'.
- ✓ Jasmonic acid and ethylene precursors, *LOX* and *SAM*, were upregulated 2 dpi in 'Hayward' and already at 1 dpi in 'Ken's Red'.
- ✓ *LOX1* and *SAM* transcriptional levels were higher in PSA-inoculated plants, compared with PSAF.

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