

Multi-dimensional approach against *Marssonina coronaria* in apple

Introduction

The apple pathogen *Marssonina coronaria* (teleomorph: *Diplocarpon mali*) has recently become a significant problem in Central European organic apple production, causing dark spots on both the leaves and fruit (Fig. 1), and early leaf fall (Fig. 2).

The pathogen most probably originates from Asia, where it accounts for crop losses of up to 28%. First symptoms can be observed in June after a humid period, leaf drop may start two to three weeks later. Severely infected trees can be completely defoliated already in August.

In Europe it was first detected in Italy in 2001 and is spreading since then in Switzerland and southern Germany (first reports in 2010), mainly in organic apple orchards and in orchards for cider production with a reduced fungicide regime.

Approach and first results

In a multi-dimensional approach, the FiBL and KOB Interreg project aims at gaining more knowledge on the biology of the fungus and on control methods in organic farming.

For example has the teleomorph *Diplocarpon mali* not yet been detected in Europe and also the form of overwintering is still unknown. Related to this, the genetic structure of the European population of *Mc* isolates seems to be relatively uniform and completely different from populations in Asia (publication in prep.).

Identification of resistant or less susceptible apple cultivars, to be directly used in apple production or as sources of resistance in apple breeding, is another important pillar in *Marssonina* control (Fig. 3).

Direct disease control with products compatible with organic farming practices is of utmost importance. Lab-studies and field testing of products against *Marssonina* leaf drop have shown that products based on clay-minerals (e.g. Myco-Sin®), (lime) sulphur or copper have high efficacy against the disease (Fig. 4).

Finally, timing of the applications based on an infection forecast model will further help to optimally use this limited set of efficient products.

Conclusions and Outlook

Marssonina disease is a new threat to European apple production. To prevent from and to counter this pathogen, a multi-dimensional approach, based on detailed knowledge of the biology of the pathogen, resistance breeding in the apple host and targeted use of direct plant protection is necessary and under development.

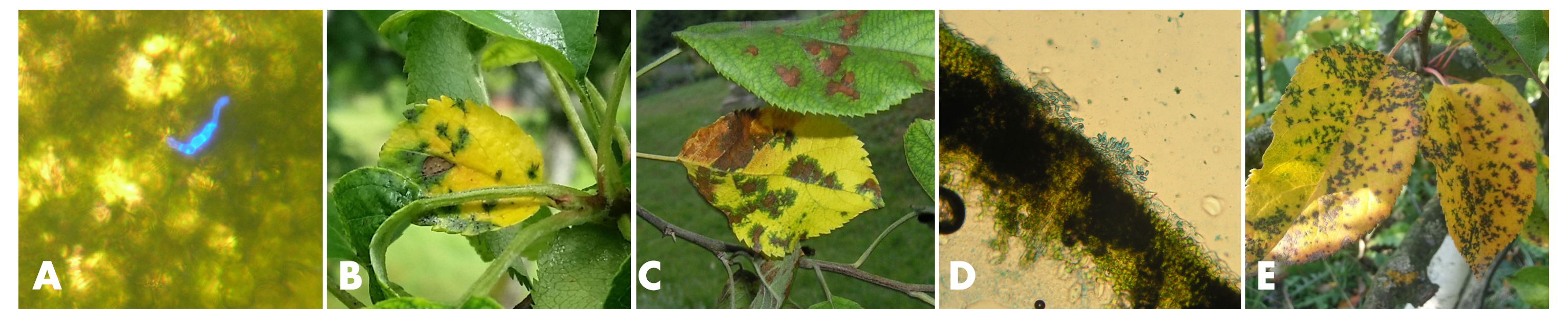


Fig. 1: *M. coronaria* infects the leaves by using appressoria and shortly afterwards forms haustoria in the host cells (A: germinating spore on leaf surface). Blackish-violet spots appear on the upper leaf side, sometimes turning into star-like lesions (B, C). On the lesions, acervuli (D) are formed, releasing new spores and eventually the leaves become chlorotic and fall off (E).



Fig. 2: Cultivars Schneiderapfel (left) and Rajika (right) under field conditions, Schneiderapfel with healthy leaves and Rajika with advanced defoliation due to infection with *Marssonina coronaria*.

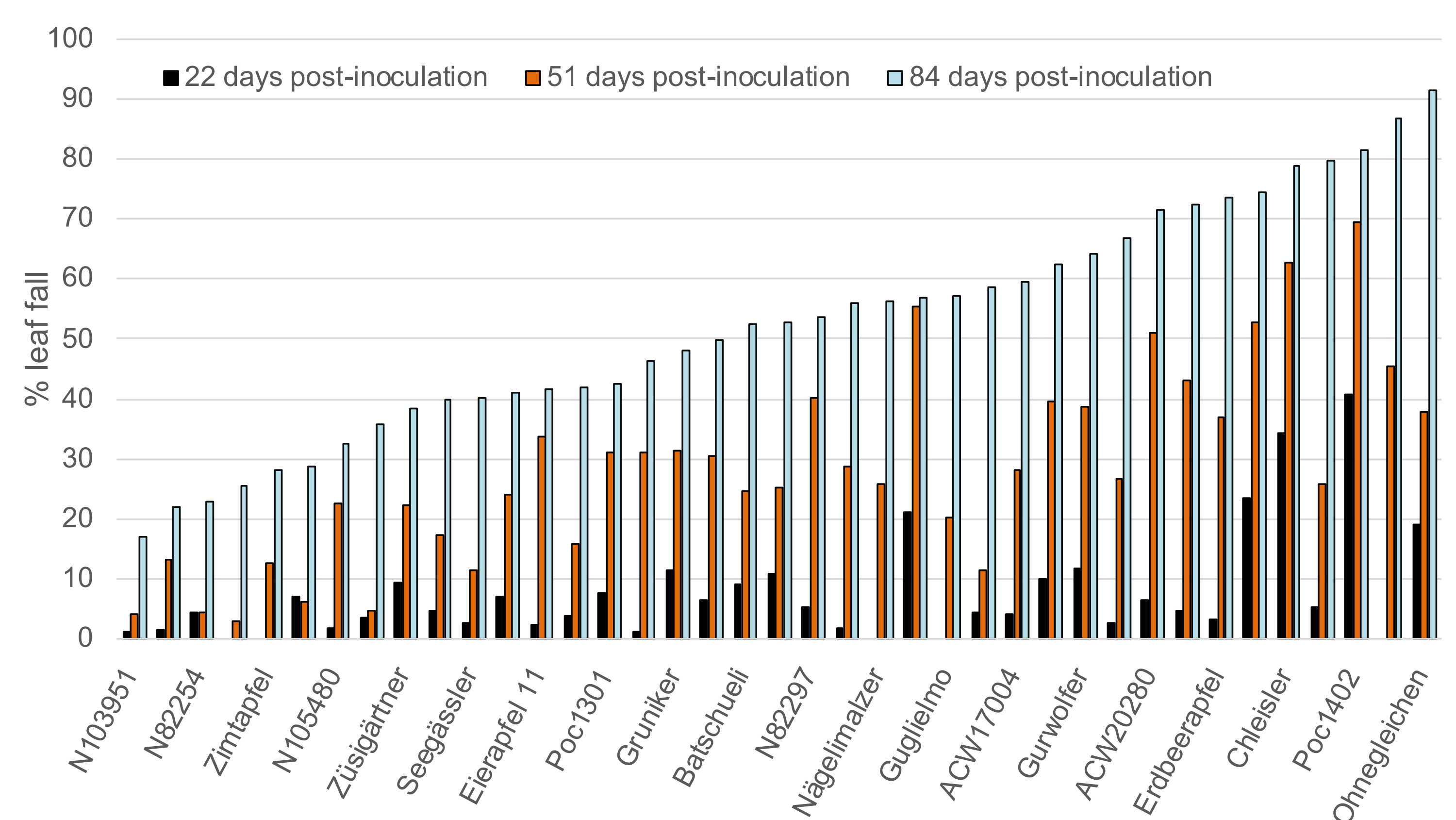


Fig. 3: Results from resistance testing against *Marssonina* leaf drop: Percentage of *Marssonina* leaf drop for 39 local cultivars or accession numbers of apple at three dates of disease assessment. Testing was done under semi-controlled conditions on potted plants, grafted on M9 rootstock (see Schaerer et al. 2018). Most tolerant/resistant local cultivars are used in resistance breeding programs.

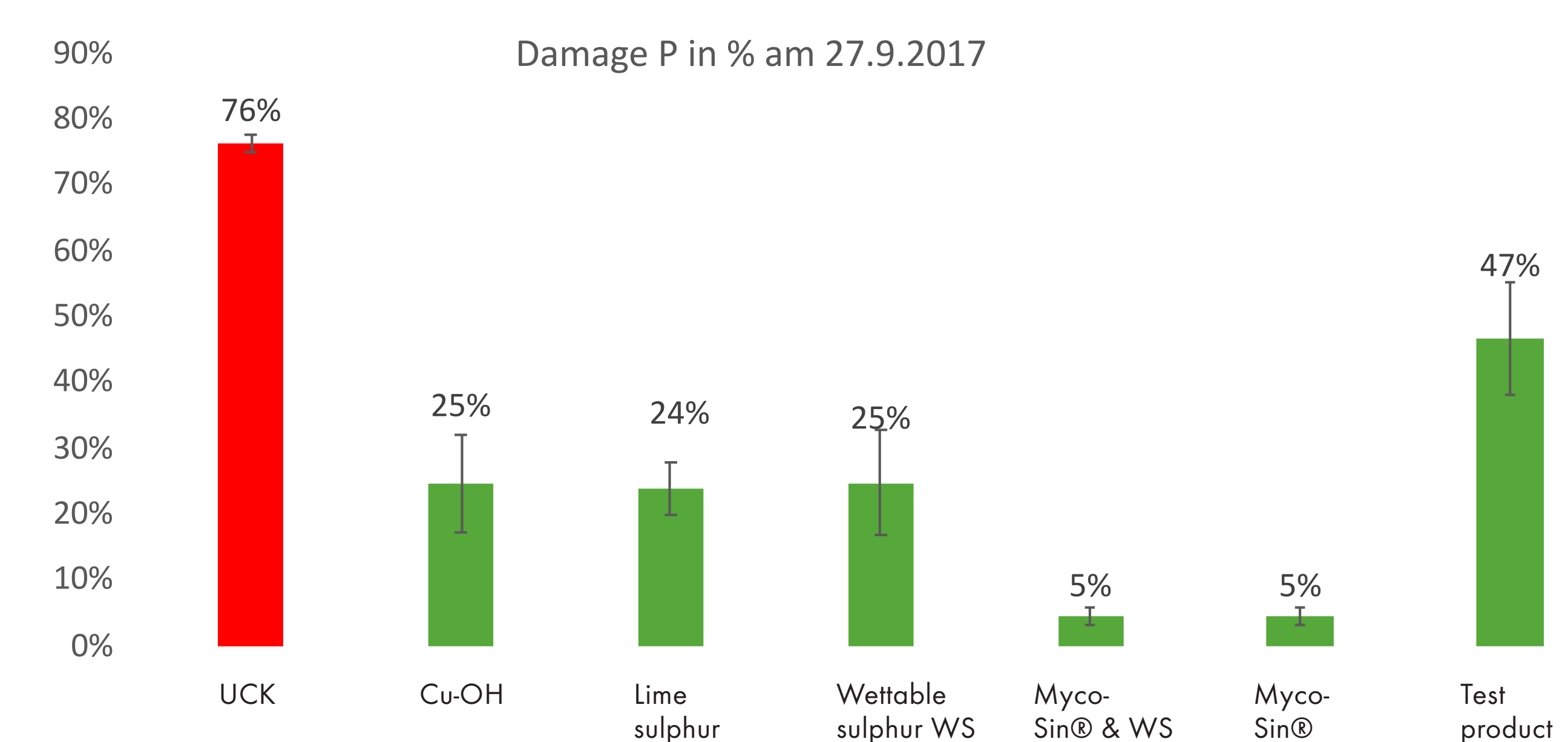


Fig. 4: Results from field testing of fungicides compatible with organic farming against *M. coronaria*. The trial included four replicates of 15 trees per test-item. Eleven treatments were applied between Mid-June and End August. Bar shows leaf damage in percent and standard deviation.

References

Schaerer HJ, Ludwig M., Oberhaensli T. and Tamm L. (2018) Testing resistance of apple cultivars to *Marssonina coronaria*. pp 226-227 in: Proceedings for the 18th International Conference on Organic Fruit-Growing. From February 19th to February 21st 2018 at the University of Hohenheim DE. <https://www.ecofruit.net/proceedings-2018.html>

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