

Testing resistance of apple cultivars to *Marssonina coronaria*

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Abstract

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, and early leaf fall. Field observations and resistance testing under controlled conditions indicate that there are differences in resistance to *M. coronaria* between cultivars. We screened 39 apple cultivars, selected from a large collection of genetic resources, for their susceptibility or resistance to *M. coronaria*. 1 year old saplings were artificially inoculated under semi-controlled conditions. The development of disease symptoms was observed and assessed several times over more than two months. Symptoms varied largely between cultivars, from small spots on which acervuli immediately developed to large round brown necrotic spots, often with one acervulus in the centre. Leaf fall often started in the middle of the shoot and in parallel on the lower, older leaves. Even though important differences in susceptibility were observed, no cultivar with complete resistance was identified. The observations suggest that resistance to the disease is complex, and involves a number of mechanisms.

Keywords: *Marssonina coronaria*, cultivars, apple, resistance, genetic resources

Introduction

The apple pathogen *Marssonina coronaria* (Ellis and Davis, 1914) (teleomorph *Diplocarpon mali* [Harada, Y. and Sawamura K. 1974]) has recently become a significant problem in Central European organic apple production. The pathogen causes dark spots on both the leaves and fruit, and early leaf fall, which may weaken the trees. Observations in the field indicate that most important cultivars are susceptible to the disease, but there is some variation in the expression of symptoms and there seem to be different levels of susceptibility or tolerance in different cultivars (Vorley et al 2014, Yin et al. 2013).

Old or local cultivars are reservoirs of genetic resources that may be exploited in breeding programs. In order to support breeding and selection of resistant cultivars for fruit and juice production, it is important to know their susceptibility to *M. coronaria*. We therefore tested 39 cultivars or accession numbers, selected from a large collection of genetic resources of apples in Switzerland, for resistance or susceptibility to *M. coronaria*.

Material and Methods

Six plants per apple cultivar were grafted onto M9-T337 rootstock and used as one-year-old saplings. Three cultivars tested before in a similar assay (Vorley et al. 2014) were included as references. The plants were maintained outdoors under a plastic roof (tunnel with both sides open during the complete season) to protect from rain. For inoculation and incubation, plants were moved to a climate chamber, after this they were again placed outdoors under rain protection.

A field strain of *M. coronaria* was maintained on seedlings of apple. Spores were collected from infected leaves showing numerous acervuli by washing off the spores into water. Spore concentration was adjusted to approx. 75'000 spores per ml. Inoculum was sprayed on all

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leaves of the test plants, according to the method described in Vorley et al. (2014). The plants were inoculated in two series of three plants per cultivar (independent replicates). Development of symptoms was scored several times by counting the number of leaves with symptoms, describing symptoms and by assessment of percentage of leaf drop.

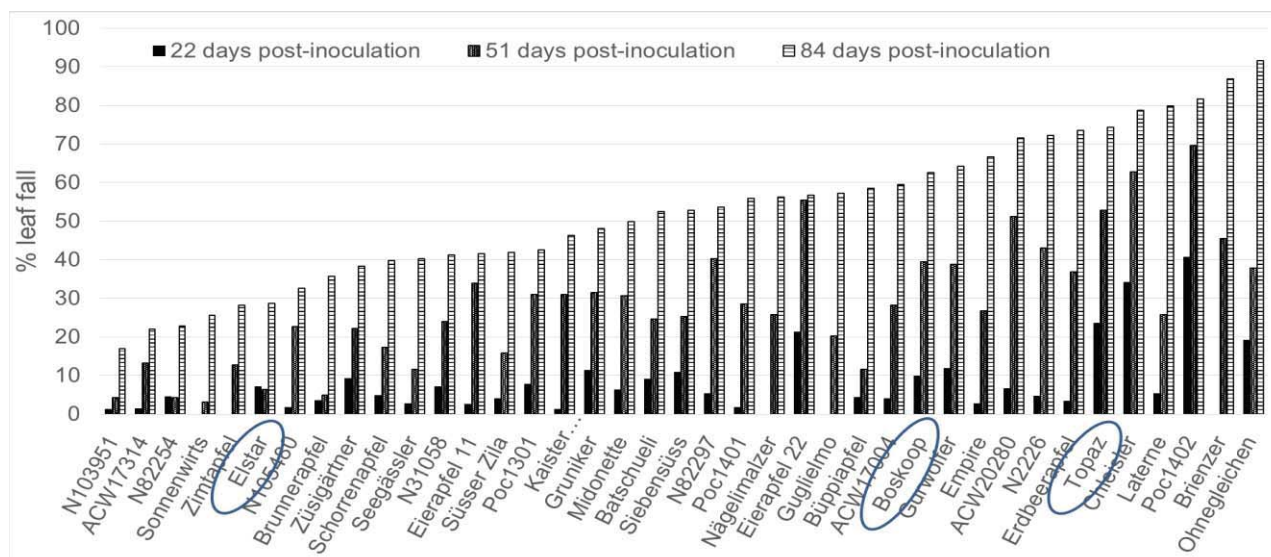


Figure 1: Percentage of Marssonina leaf drop for 39 cultivars or accession numbers of apple cultivars at three dates of disease assessment.

Results and Discussion

Important differences in susceptibility were observed (Fig 1). Reference cultivars grouped in the same rank order as in a previous experiment (Vorley et al. 2014), with 'Topaz' highly susceptible, 'Elstar' with good tolerance and 'Boskoop' between these two. This indicates that the testing system is constant and provides reproducible results.

Several cultivars showed good initial resistance to the disease, but later in the season, they ranked among the more susceptible cultivars. Symptoms varied largely between cultivars, some showing infections in the form of small spots on which immediately acervuli develop, others show round brown necrotic spots, often with one acervulus in the centre. Leaf fall often started in the middle of the shoot and in parallel on the lower, older leaves. No cultivar with complete resistance was identified. Overall, the observations and results suggest that resistance to the disease is complex, and involves a number of mechanisms.

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References

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