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European fruit sector facing Marssonina coronaria

First experiences with a new, aggressive form of premature leaf fall in apple

Info

Southeast Asia In 1992 in India, Marssonina coronaria infection in apples was seen for the first time at a few isolated farms. In 1995, 90% premature leaf fall was seen in 70,000 hectares of apple orchards as a result of this disease. The infection spread to Southeast Asia and is now one of the most important diseases of apples in India, Korea, China and Japan. Since 2010, fruit growers in Europe have been facing a new disease: *Marssonina coronaria*. This fungal disease causes severe premature leaf fall in apples, resulting in entire orchards losing their leaves before the harvest. Currently, insufficient is known about the biology of and possibilities to control the disease. Therefore, it is important to share the experience gained up to now. The disease will probably spread to northern Europe in the coming years. Marssonina control poses a major challenge in organic and low-residue apple growing.

The *Marssonina coronaria* infection in Europe probably originates from Southeast Asia. This fungal disease was first found in Europe in northern Italy in 2001. In 2009 and 2010, symptoms were found in unsprayed and extensively cultivated apple trees in southern Germany, Switzerland and Austria. In hindsight, growers and consultants think that the disease had affected these trees several years earlier, but that the premature leaf fall was not then associated with the disease. In the autumn of 2010, several organic growers in Styria (Austria) saw suspiciously high levels of premature leaf fall in Topaz – mostly at the edges of the orchards in the vicinity of untreated Meadow trees (non-professional orchards, ed. Streuobst (D)).

The summer of 2011 saw the first occurrence of serious Marssonina infection at modern, intensive organic fruit farms. Initially, it was thought that these concerned orchards of scab-resistant varieties on which a limited fungicide schedule was used. However, in 2011, serious premature leaf fall occurred in organic Gala orchards in Styria that were subject to an intensive copper spraying schedule and infections were found on Braeburn, Jonagold, Golden Delicious, Arlet, Idared and Red Delicious.

In 2012 in Styria, both the degree of infection and the number of organic farms on which premature leaf fall occurred increased considerably. A



Marssonina has spread via meadow trees to commercial orchards. Marc Trapman

Table 1. Degree of sensitivity to Marssonina coronaria per variety unde	er
practical conditions	

Extremely sensitive	Sensitive	Less sensitive
Topaz Fuji Gala	Arlet Idared Jonagold Braeburn Santana Red Delicious Luna Dalinco Mairac	Golden Delicious Pinova Elstar



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limited questionnaire has shown that Marssonina has risen from a few infected trees in 2009 to an important disease that is found at 85% of the organic farms. A comparable development is also seen in southern Germany and Switzerland. There are also reports of infection at integrated fruit farms. A summer spray schedule based on captan seems to be insufficiently effective. Marssonina has been observed in all of the apple varieties that are found on the farms, but there seems to be a difference in sensitivity (see Table 1).

Symptoms

The first symptoms of *Marssonina coronaria* are visible at the end of June/beginning of July, two to three weeks after a period of severe rain. In the lower part of the tree, on the top of old leaves, initially violet and later dark green spots are seen. The spots are 5 to 10 mm in size and have a rounded and irregular shape. They can easily be confused with other leaf spots. Most of the time, the first infection is probably not recognized. Vigorous trees and trees in areas of the orchard that remain wet for a longer period show the first symptoms of infection.

In the following weeks, the leaves turn yellow, but the spots remain green. The shape of the irregular spots suggests that mycelium is present in the leaves. In Topaz, the symptoms are very clear. For other apple varieties, the symptoms are sometimes less clearly visible and the spots can also become greyish brown or necrotic. However, they can always be distinguished from other leaf spots due to the typically black fruiting bodies they contain. In these bodies, the conidia are formed that spread this fungal disease. Two to three weeks after the first symptoms are visible, the yellow leaves fall.

Spread

In practice, it seems that there are only a few, but then serious, moments of infection during the summer. The infection does not spread gradually, but takes clear and large leaps. The first infection is limited to just a few trees in an orchard that show a few yellow leaves on their lower branches. Areas where the disease was not previously seen become infected later in the summer. In orchards that were infected in previous years, this occurs as early as the end of June/ beginning of July. After the following period of infection, infected leaves can be seen throughout the tree from top to bottom. A characteristic is that one tree can suffer from severe premature leaf fall while its neighbours do not yet display symptoms.



Marssonina spots are initially violet and later dark green.

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The third step is that circles of thirty to fifty trees lose their leaves. Prior to the harvest, or even in September or October, the last step can follow where the trees in the entire orchards lose all their leaves. Marssonina can also cause necrotic spots on fruits, but until now that seems to occur only rarely.

Infection biology resembles apple scab

Many details are still unclear. Just like scab, Marssonina overwinters in fallen leaves. According to various publications, the fungus forms ascospores just before and up to a month after the trees flower. In Asia, the assumption is that these ascospores are responsible for primary infections



The Marssonina coronaria spots contain characteris-
tic black fruiting bodies.Marc Trapman

In both Asia and Europe, the experience is that Marssonina infection follows a period of frequent and heavy rain, for instance, days with summer thunderstorms. Clearly more rain is required for Marssonina infections than for scab infections. Literature sources describe rain and high relative air humiditv to be more important infection factors than the temperature. Infections are possible at 15°C, but the optimum temperature is 18 to 25°C. Due to this wide range of infection conditions, it is plausible that the disease will also occur in more northerly areas of Europe.

Infection conditions





Two symptoms of *Marssonina coronaria*: yellow discolouration of the leaves and dark green spots.

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in May and June. However, for a fungus that overwinters in fallen leaves, it is evolutionarily unfavourable not to produce spores until May. This is because at that moment there is a reasonably high probability that the old leaves have already decomposed. In both Styria (Haidegg – Austria) and around Lake Constance (KOB-Bavendorf – southern Germany), researchers created depots of infected leaves in the autumn of 2011. However, in 2012, no ascospores were caught from these depots.



A characteristic is that one tree can suffer from severe premature leaf fall while its neighbours display no symptoms of Marssonina. Marc Trapman

It is clear that Marssonina infection in an orchard increases year by year. Various growers have noticed that the infection starts with the trees that were also infected in the previous year. This observation suggests that the fungus can also overwinter on the tree.

Control possibilities

Currently, Marssonina is mainly a problem in organic fruit production. The number of fungicides available to organic growers is limited. Researchers in South Tyrol (northern Italy), Austria, Switzerland and southern Germany are trying to obtain more insight into the infection biology and control possibilities under European conditions. In combination with literature data and practical experience, first conclusions can be derived concerning the effectiveness of the available products (see Table 2).

Future

Marssonina is spreading quickly in the fruit-growing regions in Central Europe. The expectation is that this disease will spread further to the north. It is extremely aggressive, but infections will probably only occur during a limited number of discrete rain events. To be able to control the disease effectively, we must be able to recognise these moments of infection and know which fungicides are most effective. Consultants and researchers at various institutes in Europe are working to develop this knowledge.

Table 2. Experience with the effectiveness of organic products to prevent Marssonina coronaria infection

Product	Experience
Lime sulphur	In research performed by the Laimburg Research Centre (Italy) and Haidegg (Austria) in 2012, lime sulphur was effective. In practice, Golden, Pinova and Gala orchards that were treated with lime sulphur during the summer suffered only limited infection. Strategically, lime sulphur seems to be the best product to use, because it also controls other summer diseases such as scab, mildew and Sooty Blotch.
Copper oxychloride	The literature states that copper oxychloride is effective, but then at a dose of 0.3%. That is ten times higher than the dose used to control scab in organic fruit production. In research carried out by the Laimburg Research Centre (Italy), copper oxychloride was effective, but also at a high dose. In practice, a dose between 0.03 to 0.05% proved insufficiently effective.
Sulphur	In both research and practice, sulphur proved insufficiently effective.
Potassium bicarbonate	In both research and practice, potassium bicarbonate proved insufficiently effective. In orchards that were treated with potassium bicarbonate - sulphur, in 2011 and 2012 a strong increase in infection was seen.
Mycosin	In research carried out by Agroscope Changins-Wädenswil (Switzerland), sprays of Mycosin in the period during and after flowering proved effective. In practice, Mycosin treatments in the summer offered no effective control. Mycosin sprays in the summer are difficult to fit in and have no effect on other summer diseases such as scab, mildew and Sooty Blotch.



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