Recent results of trials with plant extracts against *Monilinia laxa*, *Blumeriella jaapii* and *Gloeosporium fructigenum*

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Abstract

Since 2017 at the LVWO Weinsberg several tests in laboratory, semi-field-trials and field-trials have been carried out about the inhibiting effect of different essential oils, plant extracts and plant products on the germination of conidia of Monilinia laxa (Aderhold & Ruhland), Blumeriella jaapii *(Rehm) and* Gloeosporium fructigenum *(Berkeley). These tests are part of the BÖLN-research project about organic stonefruit-production, which is supported by the federal Ministry of Food, Agriculture and Consumer Protection (BLE) of Germany. Promising effects have been seen in the tests with Monilia and Blumeriella with preparations from Curcuma sp. (powder), Zanthoxylum sp. (oil), Palmarosa-oil, tea from* Primula veris *and with a preparation on base of a fatty acid. A tendency could be seen, that it was easier to inhibit strongly the germination of* Blumeriella jaapii *with these plant oils or plant extracts than at Monilia. For Monilia and Blumeriella the efficacy could be partly affirmed in semi-field trials with potted sour cherry plants or at blossoms of plum trees in an organic orchard.*

Keywords: organic stone fruit, *Monilinia sp.*, *Blumeriella jaapii*, *Gloeosporium sp*., plant extracts

Introduction

Cherry leaf spot is a fungal disease that infects mostly sour cherries. Premature fall of leaves weakens the trees and can result in low blossom setting, higher damages by frost in the next spring or in their death (Stegmeier et al. 2014). *Monilinia laxa* and *Monilinia fructigena* are the most important stone fruit disease worldwide (Fritsch 2009) and can cause great fruit losses. If the trees are heavily attacked, they lose lots of branches and twigs, which have to be removed, so the capacity of yield is decreasing, too. Only a few plant protection products are registered for use in organic stone fruit orchards (Rank, 2003). The fungicidal effect of essential oils has been demonstrated in several studies (detailed literature see bachelor thesis of Stoll, 2017). In this research project several essential oils or dried finely ground plant parts were tested for their potential to inhibit the germination of conidia. The selection of the variants for the semi-field and field-trials were based on the results of two large series of germinating tests in laboratory (Pfeiffer & Stoll, 1918). In this abstract only some results of the most interesting plant extracts will be shown.

Material and Methods

The conidial germination tests were performed according to the results of a bachelor thesis (Stoll 2017) and results of BÖLN-projects 02OE109 and 2809OE103 (Kollar et al. 2013). Conidia germination tests with *Blumeriella jaapii* (from infected leaves) and *Glomerella cingulate* (from fruit mummies of sour cherries) were performed with the method of Kollar (2003), similar to tests with apple scab. Each conidia germination test included normally a control variant and two variants with the fungicide Funguran progress in two different concentrations (400 g copper/ha and 250 g copper/ha) for comparison with the other variants. Fruit mummies of organic grown apples and plums with symptoms of *Monilia fructigena* were collected. Fruiting bodies of infected mummies were scraped away and

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shaken with a horizontal shaker (300 mot./min) for 10 minutes in distilled water. A conidia suspension with 40.000-60.000 conidia/ml was produced. Test products and conidia suspension were mixed in decreasing concentrations. For conidia germination tests with conidia of *Monilia fructigena* another method (Joseph, 2011) had to be applied. At all three fungal diseases the germination of 100 conidia was divided into three classes: not germinated, short germination tube, long germination tube.

The semi-field trials with the fungal disease *Monilinia laxa* were conducted on the pomicultural experimental station in Heuchlingen with container trees of the species 'Schattenmorelle' over three years. Per variant either 3 x 3 trees or 2 x 3 were infected. Two different possibilities were used for the artificial infection: First the young trees were sprayed preventively with the plant extract, some hours later with a solution of Monilia conidia (15.000 conidia/ml), afterwards they were put under a frost irrigation with an interval sprinkling for the night, because during the expected blossom period no rain has been forecasted (2017 and 2018). 2019 the method was changed, because the temperature outside were too low for good infection conditions: Directly after the artificial infection 5 marked blooming branches per tree were put into plastic bags to keep high humidity, which were removed 48 h later.

The number of infected blossoms was evaluated about 4 weeks later (classes: infected, no infection + no fruit, 1 fruit/cluster, 2 fruits/cluster, 3 fruits/cluster, 4 fruits/cluster). In an organic plum orchard with the cultivar ‘Toptaste’, which is susceptible for Monilia during blossom, a simple trial (one row = one variant, no replications) was conducted by the owner using a field-sprayer. The infections were assessed by counting the infected branches and the infected blossom-clusters per tree four weeks after the last treatment.

Potted rootstocks *Prunus avium* and Gisela 5 were used for the semi-field test with cherry leaf spot, they were sprayed preventively and put under with *Blumeriella jaapii* infected trees of the cultivar ‘Safir’ to simulate the conditions during a natural rain-period (infections over conidia, which drop with the rain through the trees). One month later the infection of each leaf was assessed at the marked branches with four classes: 1 = no infection, 2 = weak infection, 3 = middle infection, 4 = strong infection. Details about the used concentrations in the multitude of trials and a large list of literature will be published in the final report of the project.

Fruit mummies of sour cherries were put into a net over a preserving glass dangled in a sour cherry tree to collect the *Gloeosporium* conidia, which dripped down from the mummies with the natural rainfall. Samples to count the number of conidia in the rainwater were taken after each rain-period.

Results

It was a bit tricky to get good germination-rates of the *Gloeosporium* conidia in laboratory-tests, partly the conidia could not be detected because of the size of the particles of the plant oils or extracts. Here only a few promising effects could be found (figure 1). Respecting the results of a prior test, the oil of *Zanthoxylum alatum* had interesting inhibition characteristics, too. One result from the spore-trap was, that the mummies were releasing conidia during the complete vegetation season, with a maximum during periods with not too much rain, but high humidity, here the number of conidia/ml was very high.

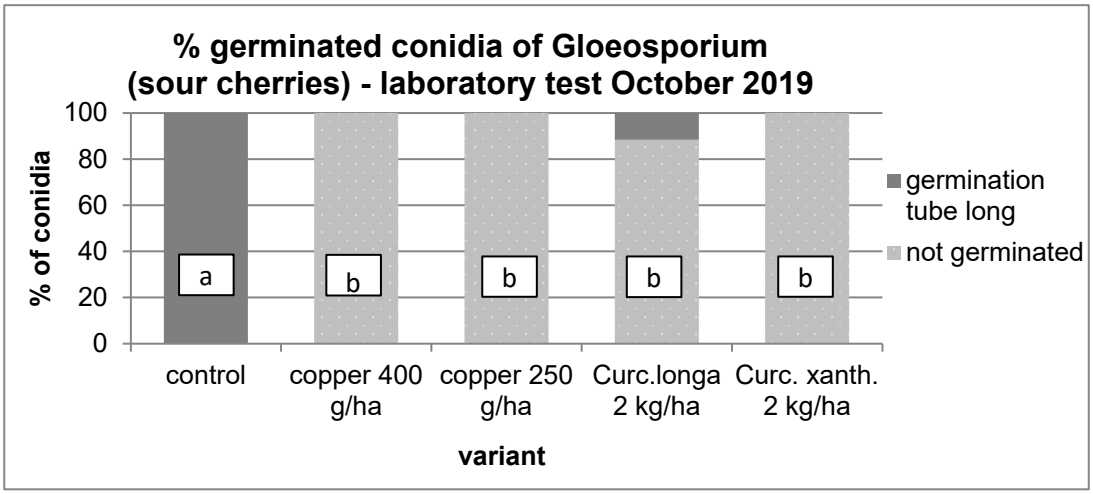

Figure 1: Percentage of conidia in two germinating classes, laboratory test at Gloeosporium/ sour cherry, α=0.05, Minitab, non-parametric variance-analysis, Kruskal-Wallis-test

A preparation with active ingredient fatty acid showed good inhibition of the germination of Monilia in laboratory, when used with minimum 2 %. Similar tendencies could be seen during the semi-field-trials at potted trees of cultivar 'Schattenmorelle': It was one of the best variants, but the influence on the fruit-setting has to be proven in further trials. In the field-trial about blossom-infections at the plum cultivar 'Toptaste' in 2019 the variant with the fatty acid-preparation showed the best results (these trees were less growing than the other rows), too, followed by *Curcuma longa* and *Curcuma xanthorrhiza* (respecting the average of infected twigs/tree). About the effect of this product on *Blumeriella jaapii* there cannot be made reliable conclusions at the moment.

Tea from *Cystus incanus*, which could have a potential because of its high contents of antioxidant qualities, was tested in laboratory tests and at Monilia with potted plants (only three trees per variant), too, where it showed a good prevention from blossom infections. The efficacy in the last laboratory tests depended from the origin and from the concentration of the tested teas. For Blumeriella the effective concentrations of the tea have to be defined more accurately.

Another interesting plant extract was a tea from *Primula veris* (brewed up with 10 g dried roots on 100 ml water, used with a concentration of 6 %), it had in some semi-field-trials a efficacy of over 90 % at Monilia. For Blumeriella in the laboratory tests this concentration partly was sufficient, partly some conidia did germinate with a short tube. Trials about the efficacy at leaf spot in the orchards just have to be conducted.

The combination of Kumar with wetting sulphur (in Germany one of the sulphur products permitted in stone-fruit-orchards is Kumulus Netzschwefel) was relatively satisfying concerning Monilia during blossom. But during summer, when thunderstorms in the evening and in the night can cause infections by leaf spot (following the forecasting model of Michigan State University, based on Eisensmith & Jones, 1981), the use of sulphur during the hot temperatures until the rain cannot be recommended.

Powders of both *Curcuma sp.* had promising effects on both fungal diseases, *Curcuma xanthorrhiza* has in general the higher potential, an effect on *Gloeosporium* has to be proofed in field, too. During the semi-field and the field trials there it became clear, that there is a minimum concentration of about 2.5 to 3.0 kg/ha and 2 m canopy height. There are

some question marks, if a wetting agent like Trifolio S should be added or not, for Monilia it seems to be wise, for leaf spot there were hints that the efficacy could decrease a little bit.

Discussion

At this point of the research work within the part of fungal diseases of the project up to now six plant extracts could be identified, if one of the tested extracts from FibL in Frick, for which we had the change to test it at Monilia and leafspot, is included. Further research work should follow to put them into strategies of a copper-free plant-protection-strategy for the organic stone-fruit-grower, combined with phytosanitary measurements. Important aspects are, if the pollination or the fruit-setting is influenced by the Monilia-treatments. Another is, if some of these promising plant extracts could be used after blossom in a way, that leaf spot and Gloeosporium can be reduced with the same extract, without damages on leaves at high temperatures.

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