Investigations of control strategies against Monilia disease in organic sour cherry production

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Abstract

In organic sour cherry production copper based fungicides are traditionally used to control brown rot blossom blight caused by Monilia laxa *Aderh. and Ruhl. (Honey). In the last years alternative treatments were investigated. Therefore whey powder, calcium hydroxide and* Aureobasidium pullulans *(BoniProtect® forte) were applied in a field trial and compared with an untreated control to determine the effect on reduction of* M. laxa*.*

The trial was arranged in an organic sour cherry orchard (2 ha) of cultivar 'Schattenmorelle' in Görlitz (Saxony), subdivided in four treatment plots. The treatments were realized four times at full bloom stages (BBCH 61-67). In addition to fungicide sanitation treatments by removing blighted twigs and mummified fruit was practiced on selected trees at burst open buds stage (BBCH 53).

The overnight freezing incubation technique (ONFIT) was used to determine the incidence of infected blossoms on twig samples with blossoms taken one day after the last application. According to that method the treatment with A. pullulans *had the significant ($p < 0,05$) best efficacy with a reduction of 78 %. Calcium hydroxide had an efficacy of 36 % and whey powder had no effect compared to the control.*

The other method to determine success of treatment was done by estimating percent of twigs showing typical blight symptoms of Monilia in relation to the complete crown about two weeks after bloom during the fruit growth (BBCH 75) which was 24 days after the last treatment. Twigs which had shown so called „early symptoms“ of Monilia at the end of bloom were marked and excluded from the final estimation. According to this method application of calcium hydroxide significantly reduced the incidence of twig blight with 72 %. Applicated whey powder led to a reduction of 48 % and the treatment with A. pullulans *to a reduction of 33 % of percent twigs with blight symptoms. Comparing the results of both estimation methods the effect of the treatments do not correspond. The treatment with BoniProtect® forte gave the best reduction according to ONFIT and by using the percent of twigs showing typical blight symptoms calcium hydroxide gave the best results.*

This may be due to different time of disease assessment. The ONFIT method shows the effect of the treatments best, as the samples were taken close to the last application. The percent of twigs showing the blight symptoms was estimated about three weeks after the last application because at this time symptoms in the trees can be recognized well. But depending on macro- and microclimatic conditions a later infection, for example from the untreated control trees, is possible. Both examination methods proved that sanitation practice in this experiment had no effect on the reduction of M. laxa*. Suggestions for following experiments are discussed.*

Keywords: organic sour cherry production, twig blight, *Monilia laxa*, biological control, ONFIT method

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Introduction

Up to now copper based fungicides are used to control brown rot blossom blight caused by *Monilia laxa* Aderh. and Ruhl. (Honey). Because of possible negative effects on environment investigations of alternative treatments are necessary (Schuster & Künstler, 2003; Holb & Schnabel, 2005). Therefore whey powder, calcium hydroxide and *Aureobasidium pullulans* (BoniProtect® forte) were applied in an organic sour cherry orchard to determine the effect on reduction of *M. laxa*. In addition to fungicide treatments sanitation was practiced on selected trees. The efficacy of treatment was determined by the overnight freezing incubation technique (ONFIT). The method was developed by Michailides et al. (2000) for the determination of latent infection with *Monilinia ssp.* on fruit of different *Prunus ssp.*. In Germany the ONFIT method was used in 2004 for the first time (Thomas, 2006). Schumann (2009) modified the method to detect the incidence of latent infected blossoms of sour cherry twigs. A common method to estimate the degree of infestation with twig blight is the observation in the orchard. This was practiced to determine the efficacy of treatments in comparison to the results of the ONFIT method.

Material and Methods

The trial was arranged in an organic sour cherry (*Prunus cerasus*) orchard (2 ha) of cultivar 'Schattenmorelle' in Görlitz (Saxony), subdivided in 4 treatment plots (0,5 ha) and 5 rows respectively. At burst open buds stage (BBCH 53) sanitation was practiced by removing blighted twigs and mummified fruit from 10 selected trees in the middle row of each treatment plot. The fungicide treatments were realized four times at full bloom stages (BBCH 61-67) (Table 1). For determination of latent infection by the ONFIT method 3 twig samples were taken from 12 selected trees (7 trees without sanitation and 5 trees with sanitation) in the middle row of each treatment plot one day after the last application. Following the sampling twigs of each tree were placed in a freezer bag respectively and equipped with humid pulp on cut surface. The bags working as mist chambers were placed in a freezer at -28 °C for 4 hours initially and further incubation was done on laboratory bench at 21 °C for 5 days (daylight). Infection was visible by sporulation of *M. laxa* and sometimes additionally other fungi.

The number of *Monilia* infected blossoms of each twig were determined with a microscope and the percentage of infection per twig was calculated. Live samples were made to examine the conidial shape and to verify the result.

Evaluation of blighted twigs in the orchard was done about two weeks after bloom during the fruit growth (BBCH 75) which was 24 days after the last treatment. Twig blight incidence was done by estimating percent of twigs showing typical blight symptoms of *Monilia* relative to the complete crown. Twigs which had shown so called „early symptoms“ of *Monilia* (Albert and Thomas, 2005) at the end of bloom were marked and excluded from the final estimation.

Table 1: Date und concentration of fungicide treatment in field trial, application rate in each treatment plot 500 l/ha, common application technique (1000l – sprayer, Fa. Holder). Before bloom 2 treatments with Funguran und Cocana and 1 treatment with Xentari.

Date	20.04.	21.04.	23.04.	25.04.
BBCH	61	65	65-67	65-67
Bloom stage	10% opened blossoms	full bloom, 50% opened blossoms	full bloom , 90% opened blossoms	full bloom, end of bloom
Treatments:				
Whey powder	35 kg/ha	17,5 kg/ha	17,5 kg/ha	17,5 kg/ha
Calcium hydroxide	24 kg/ha	24 kg/ha	24 kg/ha	24 kg/ha
A. pullulans (Boni Protect® forte)	1,2 kg/ha	1,2 kg/ha	1,2 kg/ha	1,2 kg/ha
Untreated control	-	-	-	-

Results

According to ONFIT method a high infection preasure of about 77 % *Monilia* infected blossoms was determined (Table 2). The treatment with *A. pullulans* had the significant (p < 0,05) best efficacy with a desease reduction of 78 %. Calcium hydroxide had an efficiency of 36 % and whey powder had no effect compared to the control. According to observed incidence of twig blight a low infection preasure of about 14 % was estimated. The assessed efficacy didn´t corresponed with the results of the ONFIT method. According to the observation method application of calcium hydroxid significantly reduced the incidence of twig blight with 72 %. Applicated whey powder led to a reduction of 48 % and the treatment with *A. pullulans* to a reduction of 33 % of percent twigs with blight symptoms. Sanitation practice had no significant effect (p < 0,05) on *Monilia* disease.

Table 2: Mean incidence of Monilia infected blossoms of twig samples (by ONFIT method) and resultant efficacy (Abbott) of fungicide treatments in comparison with mean incidence of twigs showing typical blight symptoms of Monilia laxa (by estimation) and resultant efficacy of treatments. Sanitation treatment is subdivided in an untreated and treated plot.

Fungicid treatments	ONFIT (latent infected blossoms)			Estimation (typical twig blight symptoms)		
	Incidence[1] [%]	*s [%]*	Efficacy[2] [%]	Incidence[3] [%]	*s [%]*	Efficacy[4] [%]
Untreated controll	76,8 c[4]	*25,5*		14 c	*10,1*	
Whey powder	87,7 c	*18,4*	-14	7 ab	*10,3*	48
Calcium hydroxide	49,5 b	*22,4*	36	4 a	*3,9*	72
A. pullulans (BoniProtect® forte)	16,9 a	*13,6*	78	9 bc	*6,5*	33
Sanitation (untreated/ treated)	57,5[3] a	58,1 a		8,3[5] a	9,0 a	

[1] Mean incidence of *Monilia* infected blossoms on twig samples
[2] ABBOTT
[3] Mean incidence of twigs showing typical blight symptoms of *Monilia laxa*
[4] Different letters behind the incidence indicate a significant difference in Tukey`s multiple comparison test ($p$ ≤ 0.05). Incidence values were transformed to arcsine square root (x) for analysis of variance and Tukey`s multiple comparison test. Values presented are nontransformed means.

Discussion

The aim of this study was the assessment of a representative efficacy for treatment against *Monilia laxa*. Comparing the results of both estimation methods the effect of the treatments do not correspond. The treatment with BoniProtect® forte gave the best reduction according to ONFIT and by using the percent of twigs showing typical blight symptoms calcium hydroxide gave the best results. This may be due to different time of disease assessment and different climatic conditions. The ONFIT method shows the effect of the treatments best because the sampling was done close to the last application. Also the conditions in the mist chamber with high and constant relative humidity and temperature are favorable for pathogen growth (Byrde & Willetts, 1977; Thomas & Racca, 2006) so enhancing the sporulating of latent infection. Estimation of twig blight symptoms give a lower infection pressure. The degree of infections of *Monilia laxa* is influenced by micro- and macroclimatic conditions (Tamm & Flückiger, 1993; Luo und Michailides, 2002). So the low number of twigs showing symptoms may be due to a period of dry weather which already prevailed during the flowering period. Later infection caused by disease transmission from the untreated control trees is possible. In future investigations a standardized ONFIT method should be established to get comparable results. New cultivars should be included. The influence of tree density and microclimatic condition on *Monilia* disease should be investigated.

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