Etiology of the corymb wilting of Elderberry and its control in organic production

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Abstract

*The corymb wilting of elderberry (*Sambucus nigra*) is the major problem in organic elderberry growing. To investigate the possibilities to regulate the necrosis the first aim of the project was to determine the pathogen, which causes the corymb wilting, its timing of infection and overwinter spots. In all tested elderberry orchards* Colletotrichum acutatum *was the main cause of the necrosis (all Koch'sche Postulates were implemented). Other fungi pathogens such as* Fusarium sp., Phoma sp. *or* Marssonina sp*. were of subordinate importance. On samples collected in winter the pathogen could be found on not yet rotted berries, corymb parts and branches as well as on apical buts of the fruit wood of the next season. A lot of fungicides and plant strengtheners allowed in organic growing were tested of its potential to control corymb wilting in laboratory and in field trials, but showed no satisfying results in controlling the disease. Because the microclimate is of importance to the infection and the infestation level, a part of an elderberry orchard was roofed over a particular time of season in two years of trials. A roof from blossom to harvest lowers the infestation by almost a hundred percent, whereas roofing from blossom until July showed only slight decrease of the infestation level.*

Keywords: elderberry, corymb wilting, *Colletotrichum acutatum*

Introduction

There are no treatment strategies to combat the corymb wilting in the organic elderberry growing by now. The aim of our project was to develop a relevant practice strategy to combat the necrosis with the combination of different methods and to establish them to the cultivation practice. To combat the necrosis, it is necessary to determine the timing of appearance of the pathogen and the pathogen itself, which is responsible for the necrosis. In Austria, *fusarium, alternaria* and *phoma* were found in fungus isolates, while *colletrotrichum* and *ascochyta* as the main cause of the necrosis were found in the LVG in Erfurt (Möhler, 2003, Steffek *et al*. 2001 and 2002).

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Material and Methods

31 preparations, accredited in the organic fruit growing, were tested for their efficacy against *Colletotrichum acutatum* in a disk-diffusion-test on a PDA-Medium. Agar disks were spread with a suspension of spores. Five filter papers, dipped in sterile water, the reference preparation 'Switch' and three different organic fungicides, were placed on the disk and incubated for seven days at 20°C (five repetitions for each variant). After incubation visual interpretations of the inhibition of the mycelia growing were made.

During season, samples of corymbs in all stages from blossom to harvest were collected to validate the appearance of *Colletotrichum acutatum.* The samples were incubated for 7 days in wet chambers at 20°C. Afterwards fruit bodies and/or spores were visually interpreted under microscope.

To detect the overwinter spots of *Colletotrichum acutatum* samples of pruning remains, one year shoots and not yet rotted leaves, berries and corymbs were collected in an elderberry orchard in December and March/April. They were treated the same as the corymbs but incubated for 20 to 22 days.

To detect the influence of microclimate, in particular the humidity, on infection time and rate, parts of an elderberry orchard in West Germany were roofed over in the season 2010 and 2011 (Table 1).

Table 1: Roof trial variants in an organic elderberry orchard, West Germany, 2010/11

variant	name
1	without roof
2	roofing from blossom to harvest
3	roofing from blossom to July
4	roofing from July to harvest

Laboratory results

Eight of 31 tested preparations in the disk-diffusion-test on PDA-nutrient solution showed a slight or middle inhibition on the mycelia growing of *Colletotrichum acutatum* (Table 2). But compared to the reference fungicide 'Switch', which causes a complete inhibition, it were only slight effects.

On the samples of corymbs in all stages from blossom to harvest, the pathogen appeared partially right from blossom on until harvest. In all orchards, the frequency of the pathogens increased dramatically at the start of ripening of the berries to a hundred percent infestation at harvest (Figure 1).

Table 2: results of the disk-diffusion-test

No.	preperation	inhibition
1	B-End (Rutaceen-Plant-Extract) 1,5 l/ha	< 1mm
2	**B-End (Rutaceen-Plant-Extract) 3,0 l/ha**	**< 5mm**
3	Polyversum 100 g/ha	no
4	Polyversum 200 g/ha	< 1mm
5	B-End + Polyversum (1,5 l/ha / 100 g/ha)	< 1mm
6	Elderberryextract T1	no
7	Black elderberry (powdered)	no
8	Wormwood (powdered)	no
9	Mistletoe (powdered)	no
10	Juniper (powdered)	no
11	Horse tail (powdered)	no
12	P1 (Trifolio)	< 1mm
13	Ventex	< 1mm
14	SPU 02700 (200 g Cu)	no
15	SPU 02700+ Polyversum (200 g Cu / 100 g/ha)	no
16	SPU 02700+ IBD B-10 (200 g Cu / 1,5 l/ha)	< 1mm
17	**Lime sulphur**	**5 mm**
18	sulphur	no
19	sulphur+ Polyversum	no
20	Vacciplant (Lamarin from brown alga)	no
21	Frutogard (phosphonate)	no
22	Amicarb (potassium-bicarbonate)	no
23	Armour-Zen (Chitosan) + Nufilm	no
24	Binab (Trichoderma) + sugar	no (no spores)
25	Folanx Ca29 (Calciumformiat)	no
26	Prev-AM (Orange-extract)	no
27	Cocana (Kali-soap)	no
28	Whey	no
29	Vitisan (potassium-hydrogencarbonate)	no
30	OmniProtect (potassium-carbonate)	no (no spores)
31	Steinhauers Mehltauschreck (sodium bicarbonate)	no
32	**Switch** (Fludioxonil + Cyprodinil)	**complete**

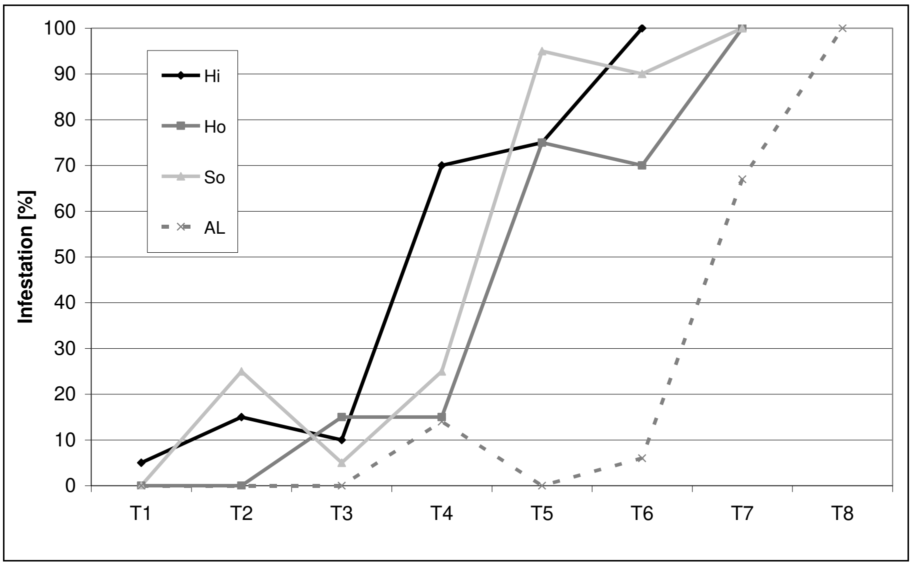

Figure 1: Percentage of infested corymbs in four different untreated orchards (Hi, Ho, So, AL) in the season 2008; T1…T8 = date of sample collection fortnightly from 29th of May to 11th of Sep

On the samples collected in an elderberry orchard in December, the pathogen could be found on not yet rotted berries and fruit stems with a frequency of 75 or 50 percent infestation. On samples collected in March and April the pathogen could be found on buts of one year shoots (fruit wood for the next season) mainly on apical spots. Also the pathogen appeared on not yet rotted branches and corymb parts of the previous season and on remaining branch parts on the tree after pruning the previous season’s fruit wood.

Field trials results

With average levels near to 80 % corymb wilting in 2011, the infestation in the orchard was much higher than in the season of 2010. Still the roofing of parts of the orchard from blossom to harvest could decrease the infestation level by almost a hundred percent in both years (Figure 2). The roofing from blossom to July had no efficacy in 2010 and only 38.5 % in 2011. The roofing from July to harvest showed efficacies of 46.8 % in 2010 and 91.7 % in 2011.

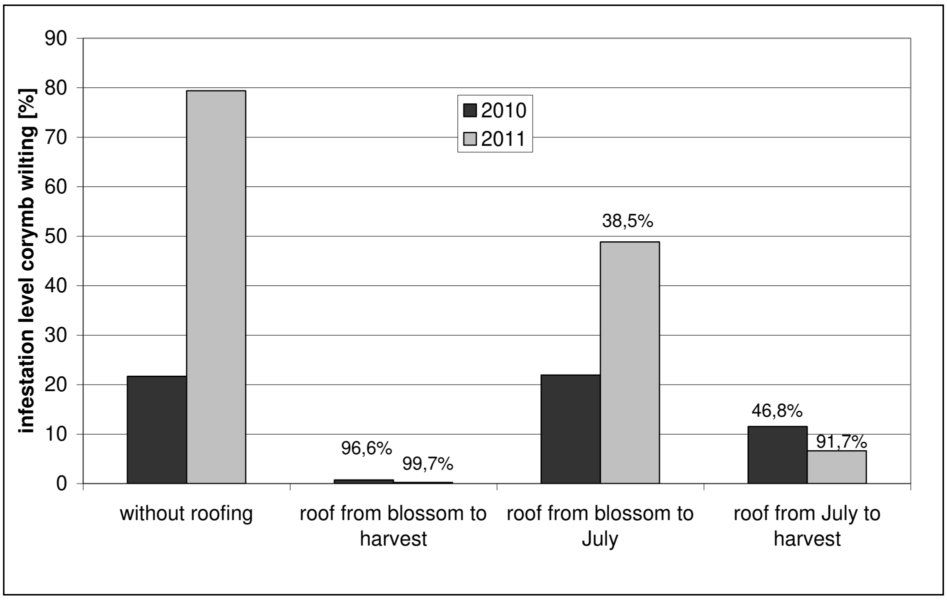

Figure 2: Infestation levels of corymb wilting at the time of first picking with and without a roof, 2010 and 2011 and efficacies of treatments

Discussion

The phytomedical diagnostic detected *Colletotrichum acutatum* as the main cause of the corymb wilting in all tested elderberry orchards in West and North Germany (all Koch'sche Postulates were implemented). Other fungi pathogens such as *Fusarium* sp., *Phoma* sp. or *Marssonina* sp. were of subordinate importance. On samples collected in winter the pathogen could be found on not yet rotted berries, corymb parts and branches as well as on apical buts of the fruit wood of the next season. During the season, the infestation level of the corymb wilting increased with the start of ripening of the berries (turn of colour from green to red/black) and reaches often infestation frequencies of a hundred percent.

The control of the corymb wilting in organic elderberry growing turned out to be very difficult. The application of usual organic fungicides such as copper, sulphur and potassium-bicarbonates tested in various exact-trials in field, proved not to be of satisfying efficacies, especially in years of high infestation levels.

Because the microclimate is of importance to the infection and the infestation level, in two years of trials a part of an elderberry orchard was roofed over a particular time of season. A roof from blossom to harvest lowered the infestation by almost a hundred percent, whereas roofing from blossom until July showed only slight or no decrease on the infestation level. Supposedly, the time of blossom is important for the infection, but roofing from July to harvest reduced corymb wilting by nearly 92% in a season of high infestation levels. It can be concluded that blossom time is of lower importance for infection than previously expected. Nevertheless a roof is not realizable in practice, due to high effort and expense.

Because there is no effective control strategy by applications, further trials to control the corymb wilting by improving the orchard sanitation should be conducted. To decrease the pathogen potential, specific treatments should be applied to eliminate overwinter spots of the pathogen in the elderberry orchards.

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