10.7251/AGSY1303573D

CONTROL OF EARLY BROWN ROT - BLOSSOM BLIGHT IN SOUR CHERRY CAUSED BY *MONILIA LAXA*

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Abstract

Early brown rot (*Monilia laxa*) in stone fruit species is an economically important fungal disease. Infection and spread occur during flowering. The infected blossoms, young leaves and shoots become necrotic and die. Cool and humid weather creates favourable conditions for early infection causing loss of flowers and great reduction of yield.

The aim of the present study was to follow out the efficiency of different fungicides applied for control of blossom blight caused by *Monilia laxa* at crucial phenological stages of sour cherry development.

Observations on *Monilia laxa* development and spread were carried out in the period 2008-2012, in a sour cherry orchard with three cultivars: ‘Oblachinska’, ‘Schattenmorelle’ and ‘Heimanns Rubin, in the region of Hisar town. In 2008 a treatment with thiophanate-methyl /Topsin M/ at the rate of 150 g/dka was applied at the flowering stage. The infection rate of *Monilia laxa*, reported after flowering, was 32% in ‘Oblachinska’ cv., 17 % in ‘Schattenmorelle’ and 8% in ‘Heimanns Rubin, respectively. In untreated trees of the same cultivars, the infection rate was 97%, 54% and 21%, respectively. In the next years 2009-2012, different fungicides were applied at the white button phenological stage, followed by spraying during flowering stage. After flowering stage, reporting the injuries caused by *Monilia laxa* showed that the infection rate was decreased and in 2012 disease development ceased.

K**ey words**: early brown rot, Monilia laxa , sour cherry.

Introduction

The early brown rot (*Monilia laxa* (Ehrenb.) Sacc.&Voglino) is an economically important fungicidal disease among sour cherries, which is widespread in Eastern and Western Europe, America and Eastern Asia (Tamm, 1993, 1995; Jones, 1996; Holb, 2008). This pathogen causes burning of the blossoms, necrosis of the petals and the twigs and rotting of the fruits. The initial infection is caused by conidia formed on the mummified fruits and the other infected tissues from the previous year. The critical period for the development of the blossom infection extends from the ”white bud” phenophase to the falling of the petals (finish blossoming). The most sensitive phase is the full blossoming phase when all parts of the blossom are susceptible to the infection (Tamm, 1993; 1995; Jones, 1996; Holb, 2008).

The cool, wet or rainy weather during the blossoming of the sour cherries is favourable for the infection of the blossoms and the extent of damages may reach 90% (Szodi, 2008; Obenaus, 2010).

An important factor for the course of the infection is the host plant. The sour cherry varieties Oblachinska and Schattenmorelle are highly sensitive to *Monilia laxa*, while Heimanns Rubin is usually attacked less (Pfeiffer, 2010).

In order to reduce the losses caused by the early brown rot, it is necessary to use chemical substances in the fight against it. Kim (2004) established in vitro that the fungicides delan, polyram, zato, strobi, bayleton, saprol, vektra, skor, topaz and chorus demonstrate high efficiency and inhibit the germination of the conidia of this pathogen.

The prophylactic spraying of copper hydroxide in combination with lime sulphur solution two or three times during the blossoming stage significantly reduces the infection of *Monilia laxa* and increases the yield (Holb, 2005).

Adaskaveg (2005) recommends applying two treatments – during the “white bud” phenophase and the blossoming stage using the fungicides pyraclostrobin, cyprodinil, fenhexamid, fludioxonil, pyrimethanil, dicloran, propiconazole, tebuconazole.

The purpose of this survey is to study the effectiveness of different fungicides used to fight the early brown rot of the type “blossom blight” caused by *Monilia laxa.*

Materials and methods

The observations on the development and the attack of the fungus *Monilia laxa* were made in a cherry orchard with three varieties of sour cherries: Oblachinska, Schattenmorelle and Heimanns Rubin during the period 2008-2012 in the region of the town of Hisar. The registering of the extent of the attack of the early brown rot of the type “blossom blight” (*M.laxa*) was performed 10 days after the blossoms had run into seeds, when the symptoms of necrosis were visible. We used a sample of 10 inflorescences taken from 5 twigs of 10 randomly chosen trees of each variety and established the percentage of the sick ones.

We observed the phenological development of the sour cherry trees by registering the highly sensitive phases – the beginning, the full blossoming and the end of the blossoming stage. We also observed the weather conditions throughout this period.

The fungicides used over the years have a contact or systemic influence when applied before and during the blossoming stage.

Results and discussions

On 7th April 2008, we conducted a treatment during the blossoming stage using thiophanate-methyl (Topsin-M 70 WP) - 150 g/dka and another treatment after blossoming on 19th April – using promicidon (Sumilexe 50 WP) – 150 g/dka (Table 1). The weather conditions (Table 2) were favorable for the accumulation of inoculum of *M. laxa* and the infection during the blossoming stage. The extent of the attack of this disease registered after blossoming was 32% for Oblachinska, 17% for Schattenmorelle and 8% for Heimanns Rubin. For the untreated trees of the same varieties, the extent of the attack of this disease was 97%, 54% and 21%, respectively (Table 3).

Table 1. Fungicidal treatments (2008-2012)

Treatment	2008		2009		2010		2011		2012	
	Data	Active ingredient/ Dose g(ml)/dka	Data	Active ingredient/ Dose g(ml)/dka	Data	Active ingredient/ Dose g(ml)/dka	Data	Active ingredient/ Dose g(ml)/dka	Data	Active ingredient/ Dose g(ml)/dka
Winter-spring	29.02.	Cupper hydroxide - 300	16.03.	Cupper hydroxide - 300	17.03.	Cupper hydroxide - 300	14.03.	Cupper hydroxide - 300	20.03.	Cupper hydroxide - 300
White bud			10.04.	Mancozeb - 300	08.04.	Thiram - 300	11.04.	Myclobutanil+ Thiram - 30+300	06.04.	Dithianon - 50
Blossom	07.04.	Thiophanate methyl - 150	18.04.	Cyprodinil - 45	15.05.	Thiophanate methyl - 150	15.04.	Thiophanate methyl - 150	12.04.	Flusilazole+carbendazim - 7,5
After blossom	19.04.	Promicidon - 150	28.04.	Thiophanate methyl - 150	23.04.	Tebuconazole-75	07.05.	Difenoconazole - 20	23.04.	Thiophanate methyl - 150

In March 2009, when observing the orchard, we found a new generation of conidia of *M. laxa* on the damaged blossoms from the previous vegetation. We also observed secretion of resin from the sick necrotic twigs. These symptoms were most visible on the plants of the Oblachinska variety. The treatments were conducted during the “white bud” phenophase, the blossoming stage and after blossoming. For the first treatment we used the contact fungicide mancozeb (Ditan M-45 WP) – 300 g/dka and the other treatments were conducted using systemic fungicides – cyprodinil (Chorus 50 WG) – 45 g/dka and thiophanate-methyl (Topsin-M 70 WP) - 150 g/dka (Table 1).

Table 2. Meteorological date

Month	Year										Media month average temperature, ^{0}C	Month average rains, mm
	2008		2009		2010		2011		2012			
	T	Rains, mm	T	Rains, mm	T	Rains,mm	T	Rains, mm	T	Rains,mm		
March	9.8	12.2	7.3	53.5	6.9	72.4	6.9	74.4	8.4	4.9	6.0	38
April	12.9	35.8	12.1	21.5	12.7	37.9	11.8	18.8	14.4	22.2	12.2	45

T - Media day temperature, ^{0}C

Table 3. Degree of assault by *Monilia laxa*

Variety	Reporting date, %									
	20.04.2008		05.05.2009		29.04.2010		10.05.2011		30.04.1012	
		Control		Control		Control		Control		Control
Oblachinska	32	97	20	96	21	98	12	87	2	50
Schattenmorelle	17	54	15	47	6	53	5	40	0	22
Heimanns Rubin	8	21	5	26	3	25	3	22	0	10

In March 2009, when observing the orchard, we found a new generation of conidia of *M. laxa* on the damaged blossoms from the previous vegetation. We also observed secretion of resin from the sick necrotic twigs. These symptoms were most visible on the plants of the Oblachinska variety. The treatments were conducted during the “white bud” phenophase, the blossoming stage and after blossoming. For the first treatment we used the contact fungicide mancozeb (Ditan M-45 WP) – 300 g/dka and the other treatments were conducted using systemic fungicides – cyprodinil (Chorus 50 WG) – 45 g/dka and thiophanate-methyl (Topsin-M 70 WP) - 150 g/dka (Table 1).

The weather conditions were favorable for the development of the pathogen and in March the rainfall was above the norm – 53.5 mm (the norm is 38 mm) (Table 2). The extent of the attack of *M. laxa* registered after blossoming was similar to the previous vegetation – 20% for the Oblachinska variety, 15% for Schattenmorelle and 5% for Heimanns Rubin. For the untreated trees of the same varieties, the damages caused by the infection were 96%, 47% and 26%, respectively (Table 3).

The temperature and the rainfall in March and April 2010 (Table 2) were favorable for the accumulation of initial inoculum of *M. laxa*, its development and the course of the infection as well. The spraying was conducted using the contact fungicide thiram (Thiram 80 WG) 300 g/dka during the “white bud” phenophase, the systemic fungicide thiophanate-methyl (Topsin-M 70 WP) - 150 g/dka during the blossoming stage and tebuconazole (Folicur 25 WG) 75 ml/dka (Table 1) after blossoming. For the treated trees, the extent of the attack was low – 6% for the Schattenmorelle, 3% for Heimanns Rubin. The attack of the disease reached 21% for the more sensitive Oblachinska variety (Table 3). As regards the control samples, the high extent of the infection was maintained, reaching almost 100% for the Oblachinbska variety.

In 2011, we applied a treatment during the “white bud” phenophase using the contact and systemic fungicide myclobutanil (Sistane super 24 EC) 30 ml/dka + thiram (Thiram 80 WG) 300 g/dka, followed by spraying of systemic preparations during the blossoming stage and after blossoming (Table 1). The combination of the two active substances during the “white bud” phenophase contributed to the reduction of the initial inoculum of *M. laxa* and the elimination of the pathogen in the cherry orchard under observation. The extent of the attack on the different varieties was low and varied from 12 to 3% (Table 3). As regards the untreated trees, the infection was high, ranging from 87 to 22%.

In 2012, the rainfall was scarce – in March it was 4.9 mm (the norm is 38 mm), in April – 22.2 mm (the norm is 45 mm). The applied fungicidal treatments were made during the critical phenophases (Table 4) using suitable preparations (Table 1). This contributed to the cessation of the infection of *M. laxa* as the extent of the attack was 2% for the sensitive Oblachinska variety.

Regarding the untreated trees of Oblachinska variety, the extent of the attack was 50% lower compared with the previous years but the yield was significantly reduced. The damages caused by the disease reached 22% for the Schattenmorelle and 10% for Heimanns Rubin.

Table 4. Fenological observations

Phenophases	Years				
	2008	2009	2010	2011	2012
Green Cone	09.03.	31.03.	27.03.	29.03.	22.03.
White bud	27.03.	10.04.	06.04.	11.04.	05.04.
Beginning of blossom	29.03.	11.04.	09.04.	12.04.	10.04.
Blossom	05.04.	18.04.	13.04.	15.04.	15.04.
End of blossom	10.04.	27.04.	20.04.	30.04.	22.04.

Conclusions

During the conducted five-year experiment (2008-2012) in a cherry orchard located in the region of the town of Hisar, we established that the fungicidal disease known as early brown rot of the type blossom blight (*M. laxa*) causes significant damages on fruit production. Out of the three monitored varieties, the most sensitive one is Oblachinska, for which the extent of the attack on untreated trees was about 90% and in the year 2012 alone it was 50%. Another variety sensitive to the disease is Schattenmorelle with damages of up to 50% and in the year 2012 alone – 22%. Heimanns Rubin was the variety less attacked by the disease, for which the extent of the attack was about 20% and in the year 2012 – 10%.

The temperature and the rainfall are the crucial factors for the accumulation of a large quantity of initial inoculum of this pathogen and the development of the infection. The inoculation takes place under a temperature of 0-5^0 C (Tamm, 1993). During the examined period of five years, the average daily temperatures in March and April were favorable for *M. laxa* – above 7^0 C and 12^0 C, respectively. Regarding the rainfall, the years 2009, 2010 and 2011 were characterized by a significant quantity of rainfall, while in the year 2012 the rainfall was scarce and the damages of the disease were smaller.

Fungicidal spraying was conducted using contact and systemic preparations. The most effective treatment included threefold spraying of the fungicides during the pre-blossoming stage, during the blossoming stage itself and after blossoming. Under this scheme of combat damage from the disease gradually reduced, as in 2012, its development is stopped.

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