Possibilities for reducing fungicide treatments in sour cherry production

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SUMMARY

The aim of this study was to investigate the possibilities for reducing fungicide treatments of sour cherry. The study was conducted in fruit bearing sour cherry orchards of the Institute of Agriculture at Kyustendil during 1991-2005. Cherry leaf spot was controlled by postinfection applications of ergosterol biosynthesis inhibitors and dodine. Bacterial canker, brown rot, shot-hole syndrome were controlled by protective treatments with copper-containing fungicides in late autumn and early spring. Insecticide treatments were applied when it was necessary. Blumeriella jaapii is the main pathogen of sour cherry which can be controlled successfully by postinfection treatments. Their number could be reduced in some years. Sprays against leaf spot were effective against other diseases too. Protective treatments against Pseudomonas syringae with copper-containing fungicides were effective against shot-hole syndrome and Monilinia laxa as well as Monilinia fructigena.

Keywords*: sour cherry, diseases, cherry leaf spot, brown rot, control*

INTRODUCTION

The soil, climatic and topographical conditions in some regions of Bulgaria are favourable for sweet and sour cherry growing and production of high quality fruits. The area of sour cherry orchards in Bulgaria was 4000 ha in 1990, but during the period of transition the area planted with sour cherry trees has decreased and reached 1540 ha in 2004. In the past two years, the areas of sour cherry orchards started to increase.

A serious problem of sour cherry growing is how to protect sour cherry from disease and pests without pesticide residues because sour cherry fruits ripen for a short time. A lot of fungi attack sour cherry but cherry leaf spot caused by *Blumeriella jaapii* (Eisensmith and Jones, 1981a, b; Velichkova-Sotiriva, 1983; Borovinova, 1998) and blossom and twig blight caused by *Monilinia laxa* (Borovinova and Sredkov, 2003; Holb, 2003, 2004; Holb and Schnabel, 2005) are the most important fungal diseases. During ripening of sour cherry, fruits can be attacked by *Monilinia fructigena, Monilinia laxa, Botrytis cinerea* and *Alternaria* spp., which cause rot.

To protect cultivars susceptible to cherry leaf spot, it is necessary to apply a maximum of 4-6 treatments during a growing season in years with favourable weather conditions (Szkolnik, 1974; Velichkova, 1983; Bielenin et al., 1991). The number of treatments can be reduced by postinfection (curative) treatments after occurrence of infection periods (Eisensmith and Jones, 1981a, b; Borovinova, 1998).

The fungus, *Stigmina carpophila* and the bacteria *Xanthomonas campestris* pv. *pruni, Bacillus pumilus, Pseudomonas syringae* pv. *siringae* which are the permanent causes of damages on sour cherry leaves, but damages are important only in some years.

Pseudomonas syringae pv. *siringae* causes serious cancers on trunks and branches during years with humid autumn and spring.

The aim of this study was to investigate the possibilities for reducing fungicide treatments of sour cherry with postinfection treatments for control of cherry leaf spot and with using of appropriate fungicides.

MATERIAL AND METHODS

The investigations were carried out in three fruit bearing sour cherry orchards of the Institute of Agriculture in Kyustendil. The study was performed during the period of 1991-1993 in an orchard with the cultivar (cv.) `Schatten morelle` planted at spacings of 5×4 m in 1981. Two plant protection technologies for control of cherry leaf spot were applied: i) conventional with protective application of bitertanol (T1) and ii) curative application of bitertanol with postinfection treatments after heavy infection according to the method of Eisensmith and Jones (1981a, b) (T2). Untreated trees were used as control.

During period 1999-2005, experiments were performed in two fruit bearing orchards (each 3 ha). One was planted with cvs. `Meteor`, `Schatten morelle`, `Érdi bőtermő`, `Újfehértói fürtös` at spacings of 5×4 m in 1981 and the other with `Schatten morelle`, `Érdi bőtermő`, `M15`, `Nefris` planted at spacings of 5×4 m in 1996. Cherry leaf spot was controlled only by postinfection treatments with tebuconazole, hexoconazole and dodine. Bacterial canker, brown rot, shot hole syndrome were controlled by protective treatments with copper − containing fungicides in late autumn and early spring. Insecticide treatments were applied when necessary.

Five to ten trees in five replications of each cultivars were evaluated, taking an average sample of 100 leaves from the four sides of each tree 14 days after the last treatment and 30 days after that for *B. jaapii* using the method of Townsend at Heuberger (Kremer and Unterstenhofer, 1967). 500 600 fruits were selected randomly from each tree and were assessed for *Monilinia* spp. The infected spurs from each tree were counted.

Statistical differences were estimated by using F-test and Least Significant Difference (LSD) values were used for comparing treatments at $P<0.05$; 0.01; 0.001 significance level (Maneva, 2006).

RESULTS

Permanent fungal diseases during the period of investigation on leaves and fruits of sour cherry were cherry leaf spot (*B. jaapii),* brown rot (*M. laxa* and *M. fructigena)* and shot hole (*Stigmina carpophila).* The main bacterial disease was bacterial cancer (*P. syringae pv siringae)* causing serious cancers on trunks and branches in the years with humid autumn and spring. The fungus *S. carpophila* and bacteria *X. campestris* pv. *pruni, B. pumilus, P. syringae* pv. *siringae* were the permanent causes for shot hole syndrome but damages were insignificant.

For the period of the investigation a minimum of 17 infection periods in 1993 and a maximum of 48 infection periods in 1999 were registered *(Table 1).* The number of periods with heavy infection was the largest in 2002 (16) and 1999 (15). During the period of 1991-1993, cherry leaf spot was controlled by 3 (1991 and 1993) and by 5 treatments (1992) in the orchard with protective treatments which were effective. The rate of attack of the leaves was very low. During the same period the disease was controlled by 1 (1991, 1993) and 2 (1992) postifection treatments which were effective too. The rate of attack of the leaves was very low except for 1991 *(Table 1).*

Table 1

Number of infection periods by Blumeriella jaapii, treatments and incidence

Years	Periods of infections of *B. jaapii* (April – August)			Number of treatments against *B. jaapii*	Fungicides and active ingredient	Incidence of *B. jaapii*					
	Light infection	Moderate infection	Heavy infection			Meteor T2	Schatten morelle			Érdi bőtermő T2	Újfehértói fürtös T2
							T1	T2	C		
1991	15	13	9	1	Baycor(Bitertanol) – 0.15%		1.71 ***	9.96 ***	21.96		
1992	5	15	5	2	Baycor(Bitertanol) – 0.15%		0.30 ***	0.08 ***	24.66		
1993	4	10	3	1	Baycor(Bitertanol) – 0.15%		0.51 ***	2.38 ***	4.49		
1999	24	9	15	3	Silit40(Dodine) 0.1%, Systane12E (Micobutanil) – 0.06% Anvil(Hexaconazol) – 0.06%	0	0			0	0
2000	7	7	4	2	Systane12E (Micobutanil) – 0.06% Folicur25WG (Tebuconazol) – 0.075%	0.9	0.27			0.5	0
2001	10	5	6	2	Folicur25WG (Tebuconazol)-0.075% Punch40EK (Flusilazol)-0.0075%	0	0			0	0
2002	5	14	16	2	Folicur25WG (Tebuconazol) – 0.075%	6.9	3.1			0.6	0
2003	11	8	5	2	Folicur25WG (Tebuconazol) – 0.075%	12.0	7.4			6.4	3.7
2004	8	6	12	2	Folicur25WG (Tebuconazol) – 0.075%	0	0			0	0
2005				2	Folicur25WG (Tebuconazol) – 0.075%	0	0			0	0

T1 – Conventional technology (with protective treatments)

T2 – Technology with postinfection treatments

C – Control – untreated

F – test = *, **, *** significant at P<0.05, 0.01, 0.001

During the next period of 1999-2005, cherry leaf spot was controlled successfully with 2 treatments in every year (except for 1999) *(Table 1).* Leaf incidence was not significant during the period of investigation. Only separate spots were found during 4 years of the investigation. During the rest of the years the rate of attack was under 1% except for 2002 for the cultivars `Meteor` and `Shatten morelle` and 2003 when it was 12% for the cultivar Meteor *(Table 1),* but this infection was established in September and probably it was not dangerous for the trees.

During the course of the study, 4 fungi species were detected in the sour cherry orchards as a causes of fruits rotting – *M. laxa* (Aderh. and Ruhl.) Honey, *M. fructigena* (Aderh. and Ruhl.) Honey, *B. cinerea* Person, *Alternaria alternata* (Fr.) Keisler. *M. laxa* was the most common brown rot pathogen. *M. fructigena* is the second pathogen, but crop losses are less than those caused by *M. laxa.* Brown rot was controlled only by one special treatment *(Table 2)* during the whole period of investigation except for 1999 when two treatments were applied because the weather conditions were favourable for a severe infection. The infection of blossoms and twigs was also low during the years of investigation *(Table 2).*

Table 2

Fungicide treatments, number of infected spurs per tree and percent of infected fruits by *Pseudomonas syringae, Monilinia* sp., *Alternaria* sp. and *Botrytis cinerea*

Years	Fungicide treatments against				Number of infected spurs, the average per tree			Percent of infected (rotted) fruits by *Monilinia* sp., *Alternaria* sp. and *B. cinerea*			
	P. syringae		*Monilinia* spp.		Schatten morelle	M 15	Nefris	Meteor	Schatten morelle	Érdi bőtermő	Újfehértói fürtös
	number	Trade name and active ingredient	number	Trade name and active ingredient							
1999	2	Champion WP(cooper hydroxide) – 0.4%	2	Metyltopsin(Tiofanat-metil) – 0.1% Sumylex 50WP(Procimidon) – 0.1%				0.29	3.96	12.82	0
2000	2	Cuprocin(cooper hydroxide) – 0.4%	1	Metyltopsin(Tiofanat-metil) – 0.1%				0.43	0	0.73	0
2001	2	Funguran OH(cooper hydroxide) – 0.4%	1	Punch 40EK(Flusilazol) – 0.0075%	0	0.25	0.82	0	0	0.4	0
2002	2	Funguran OH (cooper hydroxide) – 0.4%	1	Folicur 25WG(Tebuconazol) – 0.075%				0.44	0.24	9.97	0
2003	1	Funguran OH (cooper hydroxide) – 0.4%	1	Folicur 25WG(Tebuconazol) – 0.075%				1.85	0	6.73	0
2004	1	Funguran OH (cooper hydroxide) – 0.4%	1	Punch 40EK(Flusilazol) – 0.0075%	0	0	0				
2005	1	Funguran OH (cooper hydroxide) – 0.4%	1	Folicur 25WG(Tebuconazol) – 0.075%	1	0.16	0				

Fruits of cv. `Újfehértói fürtös` were not infected by fungi caused rot during the the 5 years of investigation. The percentage of rotted fruits of cultivars `Meteor`, `Shatten morelle` was low (below 1%). Percentage of rotted fruits reached 12.9% in 1999 regardless of the two treatments only for the cultivar `Érdi bőtermő`. Bacterial canker caused by *P. syringae* pv. *siringae* was controlled successfully by 1 or 2 protective treatments with copper-containing fungicides in late autumn and early spring and sanitary pruning when it was necessary. The trees were well-protected and only moderate damages were found.

Special treatments against shot-hole syndrome caused by *S. carpophila, X. campestri* pv. *pruni* and *B. pumilus* were not applied. The treatments for controlling bacterial cancer and cherry leaf spot were effective against shot-hole syndrome too. The infection of these pathogens was negligible.

DISCUSSION

The obtained results demonstrated that *B. jaapii* is the main fungal pathogen of sour cherry which can be controlled successfully by preventive and postinfection treatments. Preventive schedule gave effective control of cherry leaf spot and confirmed the results from previous studies conducted by Velitschkova (1983) when it was established that cherry leaf spot can be controlled successfully with 4 or 5 preventive treatments. Despite decreasing treatments to 2 or 3, the infection by cherry leaf spot

was low at orchards with curative application. This result confirms results of Borovinova (1998) on sweet cherry in Kyustendil during 1992-1995 and was similar to those obtained by Eisensmith and Jones (1981a, b) on sour cherry in USA – Michigan. The present study conducted for the long period of 1999-2005 clearly demonstrated that postinfection treatments gave good cherry leaf spot control with 2 or 3 treatments. The good protection against cherry leaf spot was the result not only of special treatments but the protective treatments against *Monilinia* spp. which coincided with some periods of infection for cherry leaf spot and were done with appropriate fungicides.

The present study clearly demonstrated that spurs and fruits of the investigated cultivars can be protected from *Monilinia* spp. by one or two special treatments. These results were similar to results of Borovinova (2004) established in sweet cherry orchards. The good protection against *M. laxa and M. fructigena* was the result not only of special treatments but also of the protective treatments with copper-containing compounds against *P. syringae* and application of appropriate fungicide for control of cherry leaf spot.

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