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Some aspects of reduced disease management against *Monilinia* spp. in sour cherry production

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Summary: The aim of this study was first to test the *in vitro* effeicacy of some fungicides against brown rot of sour cherry, and secondly to evaulate the effectiveness of reduced spray programmes against brown rot in integrated and organic sour cherry orchards. *In vitro* efficacy of 7 fungicides (Champion 50 WP, Kocide 2000, Nordox 75 WG, Olajos rézkén, Kumulus S, Rézkén, Rézoxiklorid) and another 6 fungicides (Score 25 EC, Efuzin 500 SC, Systane, Folicur Solo, Zato Plusz, Rovral) approved in organic and integrated production systems, respectively, were tested against brown rot of sour cherry. Altogether four spray programmes were performed i) standard integrated: sprays followed by forecasting systems during the season, ii) reduced integrated: sprays followed by forecasting systems but only 75% of the spray numbers used during the season-long spray programme, iii) standard oragnic: sprays applied every 7–14 days during the season and iv) reduced organic: 60% of the spray numbers used during the season-long spray programme. *In vitro* results showed that fungicides (with active ingredients of copper and sulphur) applied in organic production showed relatively high percent growth capacity of *Monilinia* fungus. Rézkén showed the highest and Kumilus S the lowest efficacy against brown rot. Fungicides applied in integrated production showed relatively low percent growth capacity of *Monilinia* fungus. Score 25 EC showed the highest and Rovral the lowest efficacy against brown rot. Field study showed that reduced spray programmes did not increase significantly brown rot incidence in the integrated field. However, brown rot incidence increased significanly (above 30%) in the reduced spray programme for the organic orchard.

Key words: brown rot, sour cherry, *Monilinia*, organic, integrated

Introduction

Rules and several tools for fungal disease and pest management are well-defined and most of them are successfully implemented for the two environmentally friendly productions systems in apple (e.g. *Anon.*, 2000; *Cross & Dickler*, 1994; *Zalom*, 1993). Disease and pest management practices in integrated and organic sour cherry production differ markedly from those in conventional production. Synthetic products are restricted in integrated and banned in organic apple production. In organic apple growing, only natural products such as compost, soluble rock powder, sulphur and copper compounds, fungicidal and botanical soaps, traps and biological methods are permitted against fungal diseases and pests according to IFOAM (International Federation of Organic Agriculture Movements) standards (e.g. *Anon.*, 2000), while many synthetic pesticides can be used in conventional apple production.

Brown rot blossom blight, caused by *Monilinia laxa* (Aderhold & Ruhland) Honey, is a devastating disease of sour cherry (*Prunus vulgaris* Mill.). The disease is endemic in Europe (*Wormald*, 1954, *Tamm* et al., 1995, *Holb & Schnabel*, 2005) and also causes epidemics in stone fruit orchards on the West Coast and in the Midwest of the United States (*Batra*, 1991, *Byrde & Willetts*, 1977, *Ogawa* et al., 1985). In rainy springs, blossom blight causes severe crop losses in sour cherry orchards in Hungary (*Holb*, 2003, *Soltész*, 1997). Depending on weather conditions, blossom blight can be controlled with one to three applications of protectant or systemic fungicides during the bloom period in conventionally grown stone fruit orchards (*Holb*, 2004, *Ogawa* et al., 1985, *Osorio* et al., 1994). Fruit rot caused by *Monilinia* spp. in sour cherry can be serious in rainy seasons. Severe rain events before harvest can cause cracking of fruit and therefore sour cherry trees require one to two fungicide applications to avoid brown rot of matured fruit (*Holb*, 2004).

The aim of our study was first to test the *in vitro* effeicacy of some fungicides against brown rot, and secondly to evaulate the effectiveness of reduced spray programmes against brown rot in integrated and organic apple orchards.

Materials and methods

Laboratory study

In vitro efficacy of 7 fungicides (Champion 50 WP, Kocide 2000, Nordox 75 WG, Olajos rézkén, Kumulus S, Rézkén, Rézoxiklorid) and another 6 fungicides (Score 25 EC, Efuzin 500 SC, Systane, Folicur Solo, Zato Plusz, Rovral) approved in organic and integrated production systems, respectively, were tested against apple scab. Fungicides were admended in PDA media. Two dosages were used: i) 1 x dosage recommended by the manufacturer and ii) 0.5 × dosage of the recommended dosage. Conidia of *Monilinia laxa* were placed on Petri dishes admended with fungicides. Dishes were incubated for 24 hours at near saturation humidity at 18 °C. Germination of conidia was evaluated after 24 hours incubation and percent growth capacity (GC) of the fungus was evaluated as GC = X / Y × 100, where 'X' is percent germination of conidia in a fungicide plate, and 'Y' is the percent germination of conidia in control plate. Differences among fungicides were tested by ANOVA at P=0.05 level using LSD test.

Field study

Field study for reduced fungicide spray programmes was performed in an integrated and an organic sour cherry orchard at Eperjeske. The orchard was established in 1997. The two production systems were applied: one following the Hungarian IFP (integrated fruit production) guidelines; and the second following the Hungarian organic production guidelines. The main cultivars of the orchards were Érdi bőtermő and Újfehértói fürtös. The experiment was done on cultivar Érdi bőtermő. The applied fungicides in the organic spray programmes were: Champion 50 WP, Nordox 75 WG, Olajos rézkén, Kumulus S, and Rézoxiklorid. The applied fungicides in the integrated spray programmes were Score 25 EC, Systane, Folicur Solo, Rovral.

Altogether four spray programmes were performed two for the integrated and another two for the organic fields in 2008 and 2009. The two integrated spray programmes were: i) standard: sprays followed by forecasting systems during the season, ii) reduced: sprays followed by forecasting systems but only 75% of the spray numbers used during the season-long spray programme. The two organic spray programmes were: i) standard: sprays applied every 7–14 days during the season and ii) reduced: 60% of the spray numbers used during the season-long spray programme.

At the end of May, incidence of brown rot on 5 trees were assessed for each treatments. 20 shoots per tree were selected randomly and counted for brown rot symptoms. At the end of July, incidence of brown rot on fruits on 5 trees were assessed for each treatments. 50 fruits per tree were selected randomly and counted for brown rot symptoms. Differences among spray programmes of integrated and organic were tested separatelly. Statistaics were performed by ANOVA at P=0.05 level using LSD test.

Results and discussion

In vitro *study*

Fungicides (with active ingredients of copper and sulphur) applied at 1 × dosage recommended by the manufacturer in organic production showed relatively high percent growth capacity of *Monilinia laxa* (25–55%) (*Figure 1*). Especially sulphur had low *in vitro* effeciacy against brown rot. Rézkén showed the highest and Kumilus S the lowest efficacy against brown rot.

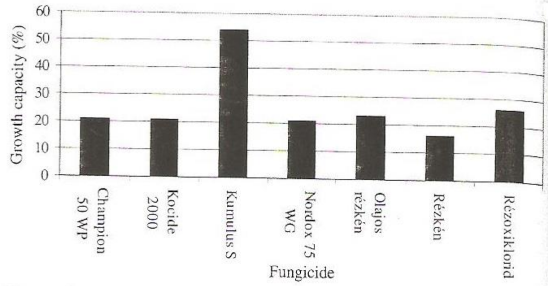

Figure 1. Percent growth capacity of *Monilinia laxa* for 7 fungicides (organically approved) admended on PDA plates at 1 × dosage recommended by the manufacturer ($LSD_{0.05}$ = 6.1)

Fungicides applied at 1 × dosage recommended by the manufacturer in integrated production showed relatively low percent growth capacity of *Monilinia laxa* (2–12%) (*Figure 2*). Rovral showed the highest efficacy against brown rot.

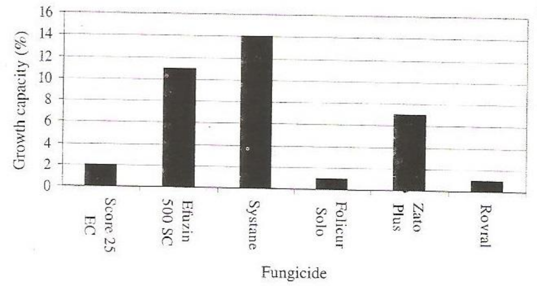

Figure 2. Percent growth capacity of *Monilinia laxa* for 6 fungicides (approved in integrated production) admended on PDA plates at 1 × dosage recommended by the manufacturer ($LSD_{0.05}$ = 2.8)

Fungicides (with active ingredients of copper and sulphur) applied at 0.5 × dosage recommended by the manufacturer in oranic production showed relatively high percent growth capacity of the brown rot fungus (46–80%) (*Figure 3*). Again sulphur had very low *in vitro* effeciacy against brown rot. Again, Rézkén showed the highest and Kumilus S the lowest efficacy against brown rot.

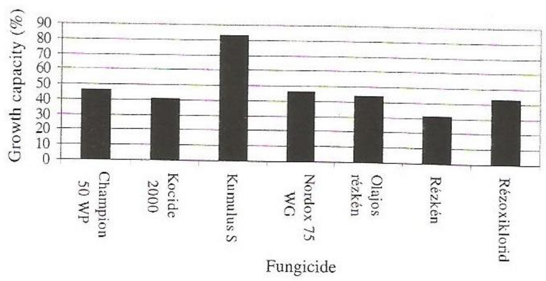

Figure 3. Percent growth capacity of *Monilinia laxa* for 7 fungicides (organically approved) admended on PDA plates at 0.5 × dosage recommended by the manufacturer ($LSD_{0.05}$ = 9.7).

Fungicides applied at 0.5 × dosage recommended by the manufacturer in integrated production showed relatively low percent growth capacity of the brown rot fungus (2–12%) *(Figure 4)*. Again, Rovral showed the highest efficacy against brown rot.

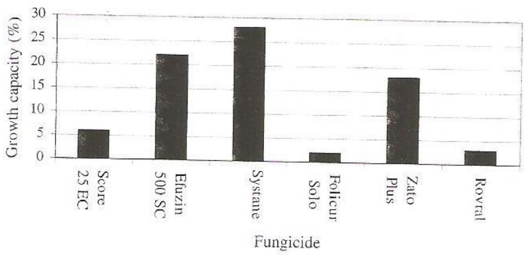

Figure 4. Percent growth capacity of *Monilinia laxa* for 6 fungicides (approved in integrated production) admended on PDA plates at 0.5 × dosage recommended by the manufacturer ($LSD_{0.05}$ = 5.2).

Field study

Brown rot incidence of shoot and fruit did not incerased above 20% and 5%, respectively, in the integrated orchards. However, brown rot incidence of shoot and fruit was above 45% and 25%, respectively, in the organic field *(Figures 5 and 6)*. Reduced spray programme did not increase significantly brown rot incidence of shoot and fruit in the integrated field. However, brown rot incidence of shoot and fruit increased significanly (above 20%) in the reduced spray programme for the organic orchard.

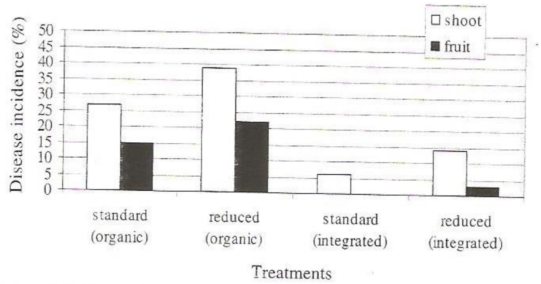

Figure 5. Efficacy of standard and reduced spray programmes on brown rot on shoot and fruit in integrated and organic sour cherry orchards in 2008 ($LSD0_{.05}$ = 4.8 – integrated (shoot); LSD0.05 = 7.6 – organic (shoot); $LSD_{0.05}$ = 4.4 – organic (fruit)).

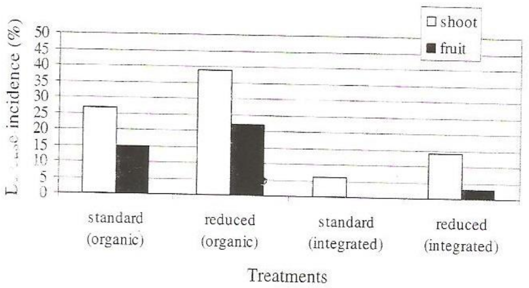

Figure 6. Efficacy of standard and reduced spray programmes on brown rot on shoot and fruit in integrated and organic sour cherry orchards in 2009 ($LSD_{0.05}$ = 3.2 – integrated (shoot); $LSD_{0.05}$ = 9.4 – organic (shoot); $LSD_{0.05}$ = 5.2 – organic (fruit)).

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