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Preliminary trials on treatment of esca-infected grapevines with trunk injection of fungicides

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Summary. An increase in trunk diseases (due to esca, Agrobacterium, rugose wood virus, leaf roll viruses, phytoplasma etc.) leading to young vines death is a very serious worry in vineyards in Hungary, as it is in other countries. In response to a demand expressed by grapevine growers, a method was tested for the direct treatment of pathogens in wood tissue. An experiment based on trunk injection was carried out in an esca infected vineyard. The various fungicides (propiconazole, difenoconazole, thiabendazole; propiconazole+ thiabendazole) were injected into the trunk before the beginning of the xylem sap flow at high pressure. As a result the number of symptomatic plants was decreased, and the vigour of the plants was not impaired by the fungicide ingredients. The combination difenoconazole+ thiabendazole showed the best result.

Key words: wood diseases, esca, chemical control, fungicide, trunk-injection.

Introduction

The spread of esca symptoms has been studied in young and old Hungarian vineyards since 2001 and is causing serious concern (Dula, 2003.) The annual average of surveys carried out in 11 wine growing regions by the Plant Protection Service (data not published) shows a dramatic increase in the number of vines showing esca (Fig. 1). The disease has become established in all vineyards, but it causes serious problems mainly in two wine growing regions, the south shore of Lake Balaton (Balatonboglár) and the foot of Mátra hill (Nagyréde) (Fig. 2). There is an urgent need to develop an effective method to manage this disease. It is well known that the different fungal pathogens that cause esca symptoms are present in the woody part of the trunks, yet a foliar spray to counter them does not exist (Di Marco *et al*., 2000) An effective method to treat symptomatic trunks is needed that applies the active ingredients or products directly to the infected tissues. An effective method currently exists, based on trunk injection, to protect ornamental and fruit trees, against various diseases and pests (e.g. Phytophthora root rot, anthracnose, fire blight, canker blight or Pierce's disease in the case of grapevine) and it seemed interesting

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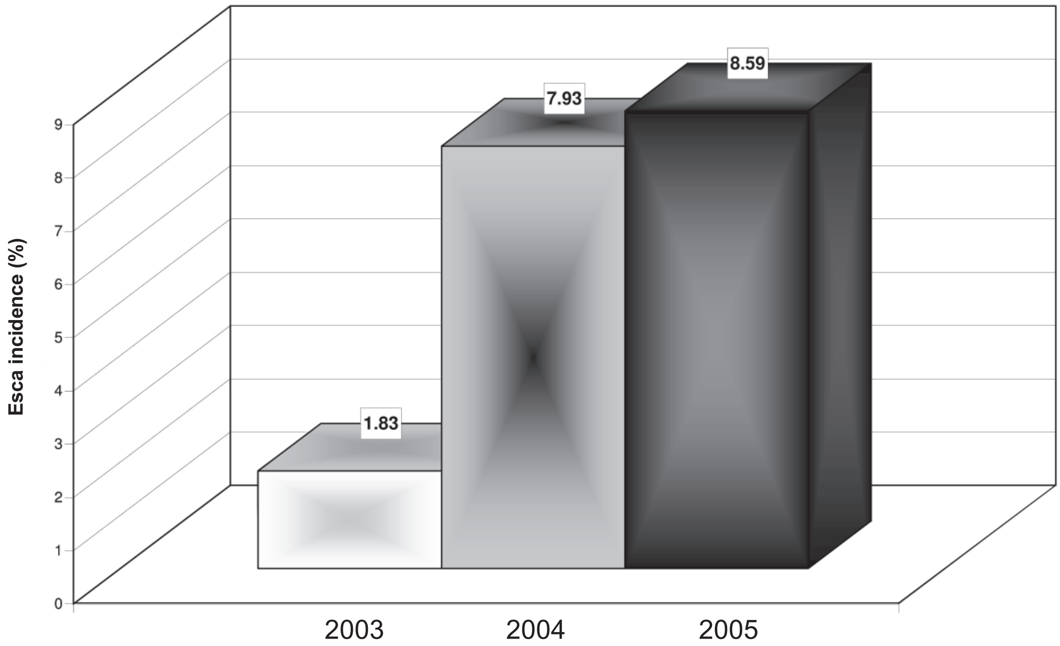


Fig. 1. Incidence of esca in Hungary in a 3-years survey (2003–2005).

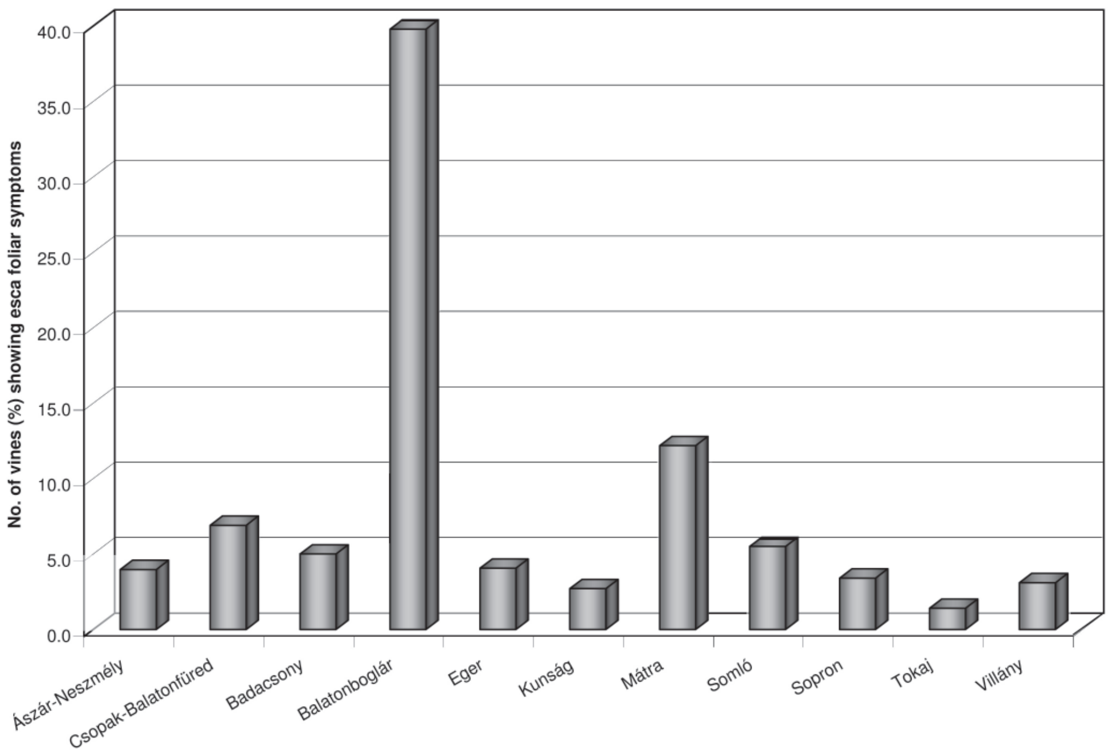


Fig. 2. Proportion of esca symptomatic vines in Hungary in 11 wine region. (3 years' average, 2003–2005).

to try this method against esca. (Darvas *et al*., 1984; Lim *et al*., 1990; Peterson 1998; Doccola *et al*., 2003; Calzarano *et al*., 2004). Initiated by Syngenta Ltd., we established a trial in 2005 to control esca by injecting fungicides into the trunks of symptomatic plants.

Materials and methods

The experiment was carried out in the second most severely infected grapevine growing region of Hungary in Nagyréde at the foot of Mount Mátra. We have been conducting surveys there since 2003. The incidence of esca symptoms in a 17-year-old Cabernet Sauvignon vineyard with umbrella training was 4.2% in 2003, 15.6% in 2004 and 16.7% in 2005. Twenty trunks bearing moderate leaf symptoms (based on the survey of 2004) were treated with each compound or combination of compounds. A 6-mm diameter hole was drilled to a depth of 25 to 100 mm (depending on trunk size) horizontally into the trunk of the vine. Forty ml of fungicide solution was injected at 30–40 bar pressure into each of the freshly drilled holes, using a StemJect® (Chemcolour Industries Ltd., Auckland, New Zealand) injector (Fig. 3) before the beginning of the xylem sap flow in spring on 7–8 March 2005. After the injection, the holes were sealed with silicone stoppers. Products, or rather active ingredients used (Table 1) were selected based on a preliminary laboratory evaluation performed by Bernd Loskill in Geisenheim (Germany).

The effectiveness of the active ingredients was compared to a water-treated control and a group of untreated vines.

The number of symptomatic vines and the severity of the leaf symptoms were evaluated two times, on 21 July and on 27 September, using a 4 point symptom severity scale (0, asymptomatic; 1, slight leaf symptoms; 2, severe “tiger stripe” leaf symptoms; 3, fruit dry up and black measles on the berries; 4, vine apoplexy).

Results and discussion

At the end of July the number of vines with esca symptoms was moderate and was smaller in the fungicide-treated plots than in the untreated control. Esca increased in the experimental area in August due to intensive rainfall. Great differences in control effectiveness were observed in the Sep-

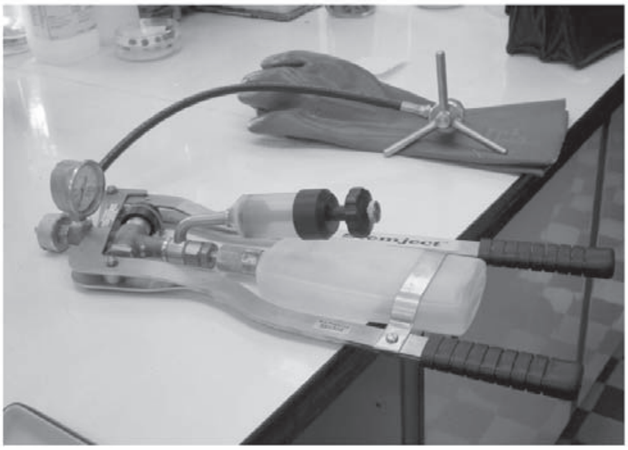
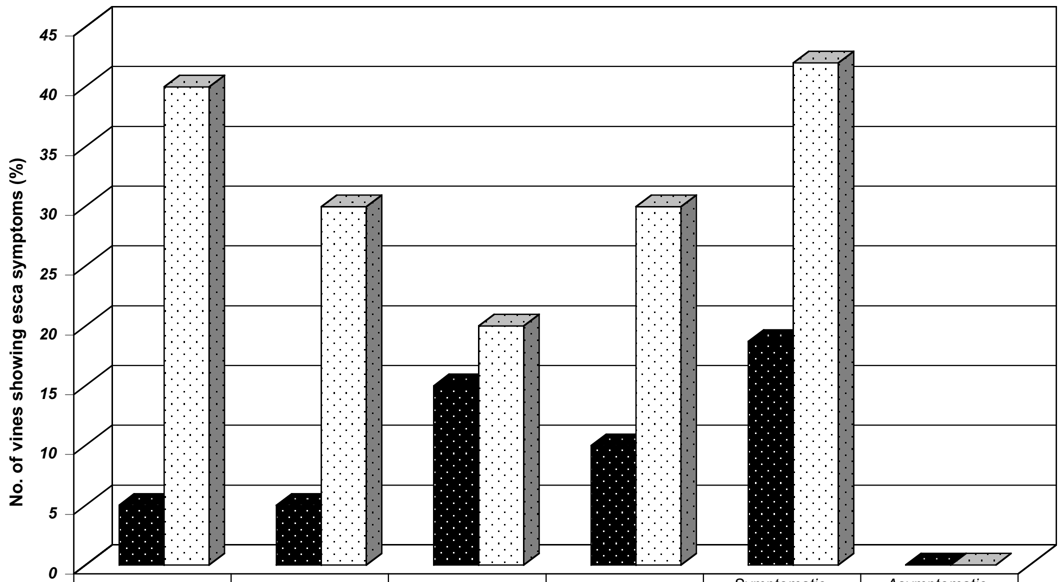


Fig. 3. StemJect® injector used for the experiment.

Table 1. Products/active ingredients used in the experiment.

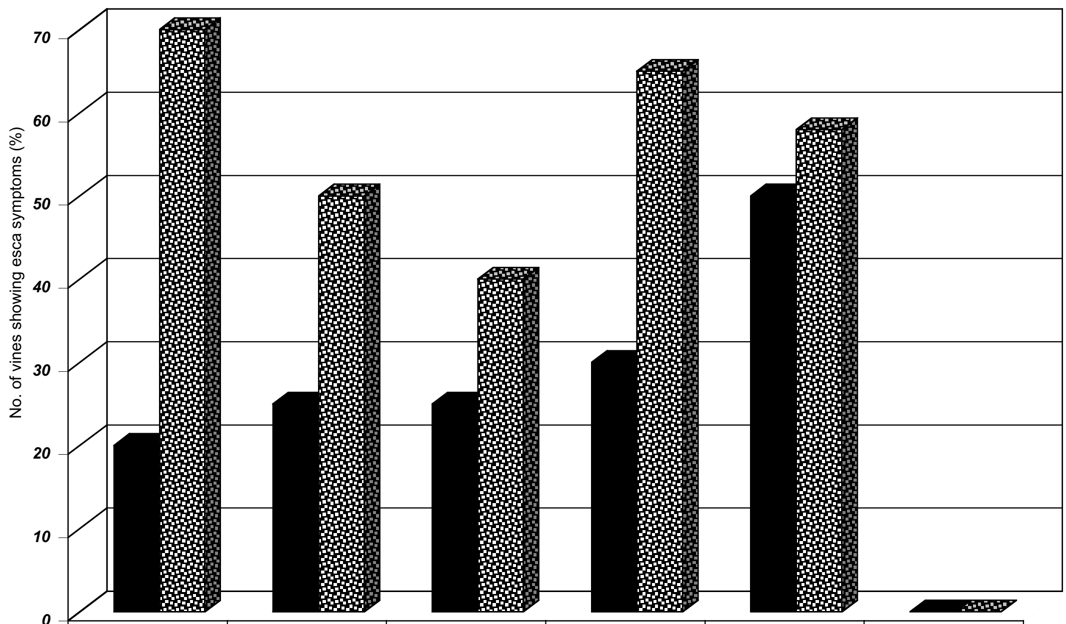
No.	Treatment or active ingredient[a]	Dosage ml l^{-1}
1	Water-treated symptomatic plants (WT)	-
2	Propiconazole (PPZ)	120
3	Difenoconazole (DFZ) + thiabendazole (TBZ)	120 + 60
4	Propiconazole (PPZ) + thiabendazole (TBZ)	120 + 60
5	Symptomatic untreated plants	-
6	Asymptomatic untreated plants	-

[a] Commercial products: PPZ, Tilt 250 EC® (Syngenta Crop Protection, Basel, Switzerland); Score DFZ, 250 EC® (Syngenta); TBZ, Mertect 340-F® (Syngenta).



	Water-treated	PPZ	DFZ+TBZ	PPZ+TBZ	Symptomatic untreated	Asymptomatic untreated
■ 21-07-2005	5	5	15	10	18.7	0
□ 27-09-2005	40	30	20	30	42	0

Fig. 4. Proportion of vine plants cv. Cabernet Sauvignon treated with trunk injection showing esca symptoms. For abbreviations see Table 1.



	Water-treated	PPZ	DFZ+TBZ	PPZ+TBZ	Symptomatic untreated	Asymptomatic untreated
■ 21-07-2005	20	25	25	30	50	0
▣ 27-09-2005	70	50	40	65	58	0

Fig. 5. Evaluation of esca symptom severity of cv. Cabernet Sauvignon treated with different trunk-injection applications. For abbreviations see Table 1.

tember evaluation: the severity of symptom expression was significantly lower in all fungicide treatments compared with the untreated and water-treated controls (Fig. 4 and 5).

The effectiveness of the active ingredients applied by trunk injection was good except for PPZ+TBZ for the proportion of plants showing esca symptoms (Fig. 4). The first year's results were promising, as the health status of diseased plants did not worsen as much in the treated plots as in the untreated and the water-treated controls, even under conditions conducive to the appearance of esca symptoms. Of the three fungicide variations the combination DFZ+TBZ (Score 250 EC+Mertect 340-F) showed the best results. No phytotoxic symptoms have appeared on the treated plants.

The trial was undertaken because trunk injection is a method that growers favour for a number of reasons. It is simple, sparing with chemicals and economic from an environment protection point of view since direct treatment of only symptom-bearing trunks decreases the chemical load placed on the environment as a whole. It also potentially enables treatments for different infections to be combined into one operation.

The experiment was followed in 2006 in the light of these preliminary results but must necessarily be confirmed by a longer period of observation, due to the fluctuations in appearance of esca symptoms in different years. Furthermore it should be taken into account that, besides the peculiar characteristics of the disease, other factors that strongly affect the efficacy of the treatment are the stage of disease development and environmental factors, and also some limitations of the trunk injection application technique in the absorption and activity of the fungicide (Darrieutort and Lecomte, 2007). Other authors, after 8–10 yrs trials, showed that the reduction of foliar symptoms following trunk injection can be long lasting, but non-permanent (Di Marco *et al*., 2000). Better results were obtained when trunk injection was associated with trunk removal (Calzarano *et al*., 2001).

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