



Evaluation of the impact of natural infections with *Erwinia amylovora* in quince (*Cydonia oblonga*) on some quality characteristics of fruits

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Abstract: The objective of this study was to determine the impact of natural fire blight infection on fruit quality in two quince cultivars (*Bereczky* and *Aurii*), by morphological (size, mass, shape index, etc.), sensorial (firmness) and biochemical (titratable acidity, soluble sugars) traits.

• Introduction

Erwinia amylovora can survive as an endophyte or epiphyte in infected or asymptomatic parts of plants; therefore, its spread is extremely difficult to control, and the generated economic losses are huge. In recent decades, the main attempts to breed and select new varieties and genotypes of quince (*Cydonia oblonga*) have focused on several main objectives, including fire blight tolerance, spotting leaves and fruits, increased tolerance to leaf chlorosis, etc.

• Material and method

Bereczky -an old quince variety dating back to the time of the Habsburgs, named after Hungarian pomologist Máté Bereczki (1824-1895). It is a famous quince with fragrant and juicy fruits of limony-yellow color, covered with a grayish-brown fluff before maturity.

Aurii- romanian quince variety, clone of Bereczky, with large, aromatic, globular fruits with wide ribs and thin pericarp, yellow-orange color, crispy, yellowish and dense pulp.

Experimental variants. The fruits were harvested from healthy plants (control -C) and naturally infected (I) with fire blight from an organic orchard in the Cluj area. The intensity of infection was severe, with more than 50% of the plant canopy volume affected. The fruit was taken at commercial maturity for both varieties at the beginning of October.

Morphological parameters of fruits. A sample size of 8 fruits per cultivar and experimental variant was evaluated according to U.P.O.V. morphological parameters: fruit weight, height and equatorial diameters were determined, and shape index were calculated. Fruit weight was accounted by a Kern digital bench scale (model BLJ-510 3M, 0.1mg accuracy). Fruit equatorial diameter and height were measured with a Neiko Electronic Digital Caliper (0.01 mm accuracy).

Sensory and biochemical parameters. Pulp firmness was definitively assessed by a Force Gauge PCE-FM 200 penetrometer. Several analysis were conducted to assessed some chemical traits (pH, titratable acidity (TA), total soluble solids (TSS)) and maturity index (TSS/TA) were calculated. Three juice samples of 2 fruits each were used to perform the chemical analysis. Juice pH was determined by a Consort pH-meter (model C 933); total soluble solids (TSS) were measured with an Hanna refractometer (model HI 96801 0.2 % Brix accuracy); titratable acidity values (TA) were determined by acid-base potentiometer (NaOH, 0.1N up to pH 8.1) and expressed as grams per 100 g (%) of malic acid [25], and maturity index (MI) was calculated by the following ratio: TSS/TA.

For all determination were calculated the average and standard deviation using basic function of Microsoft Excel.

• Results and discussions

It is proven that biotic and abiotic stressors affect plant productivity, especially the number of fruits, their size and mass. The analysis of experimental data obtained on the impact of natural infection with fire blight on the diameter and height of fruits in the two quince varieties tested (Fig.1) confirms that the stress generated by the disease causes significant reductions in fruit size

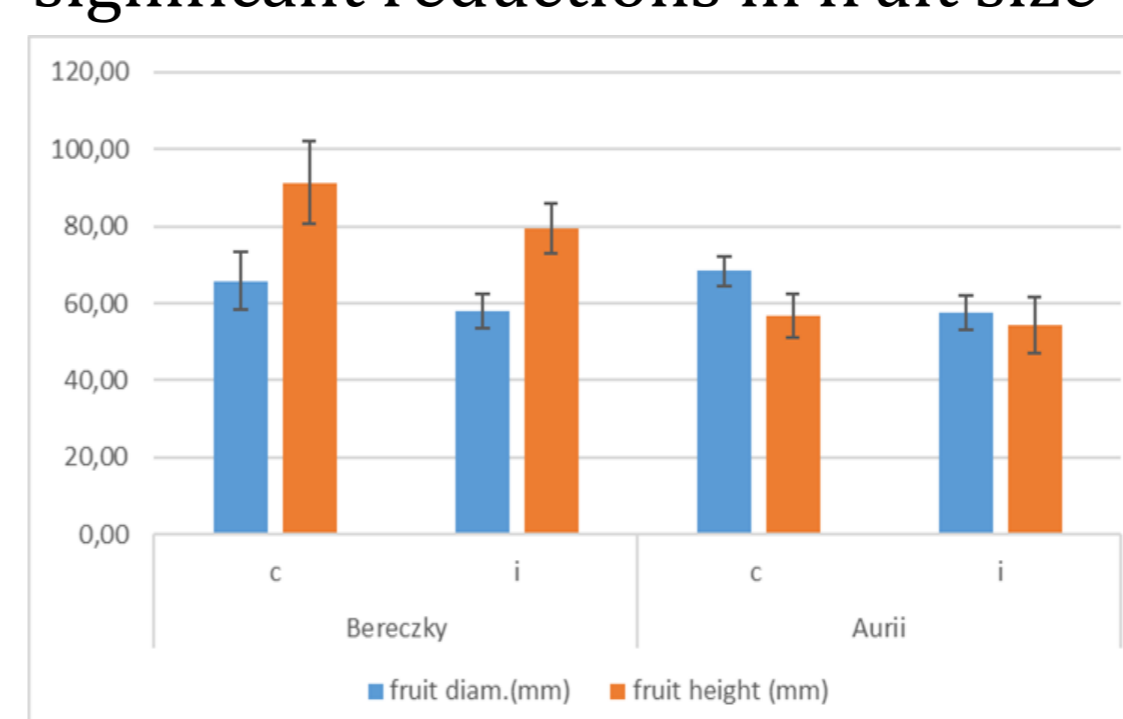


Fig.1. Diameter and height in fruits quince cultivars (c- control; i- infected)

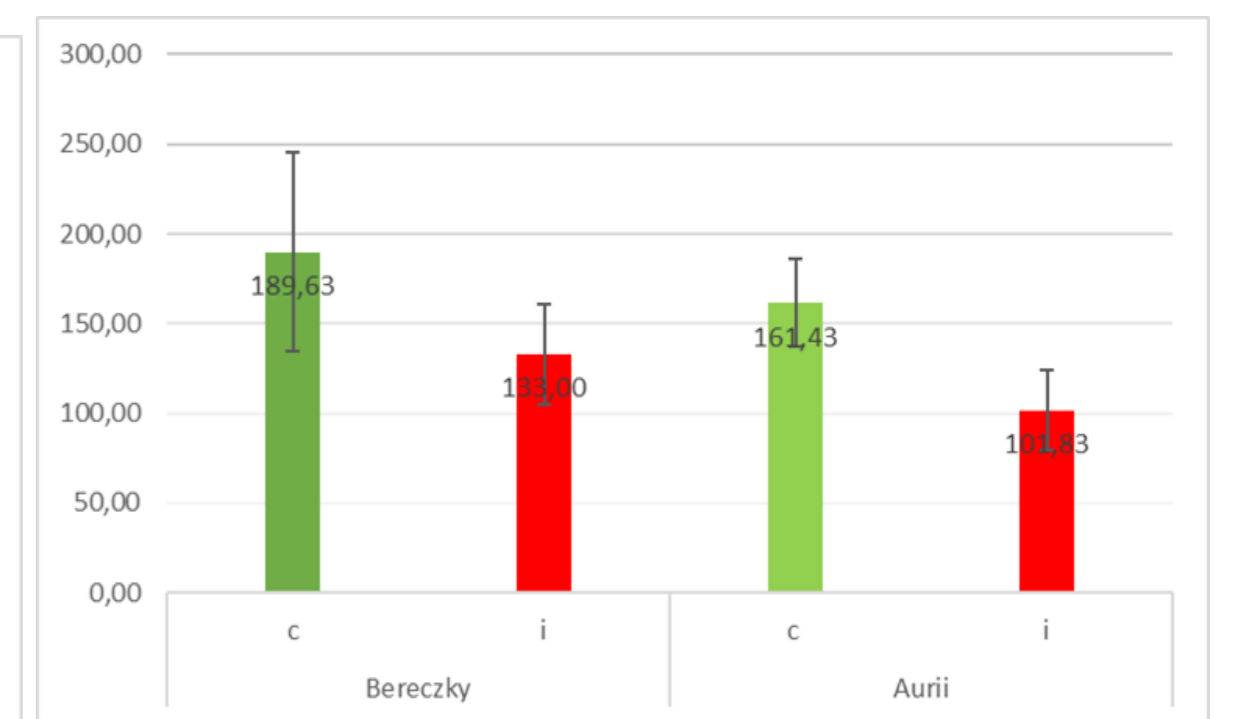


Fig. 2. Fruit mass (g) of quince varieties

The fruit mass (fig.2.) was also negatively affected by the stress induced by the fire blight attack, so in the Bereczky cv., the average weight of a fruit in control was 189.63 ± 55.36 g, compared to 133.00 ± 28.00 g in infected (difference -30%). The Aurii cv. showed a similar trend, the average weight of fruits in control was 161.43 ± 24.44 g, compared to 101.83 ± 22.03 g in infected, with a difference of 37%, in favor of the control.

Fruit firmness is an important quality indicator with implications for handling, transport and storage capacity. Firmness is a primary indicator in characterizing fruit texture and a key determinant of quality.

Dry weight (DW), total soluble sugars (TSS), titratable acidity (TA) and maturity index (MA) in quince cultivars

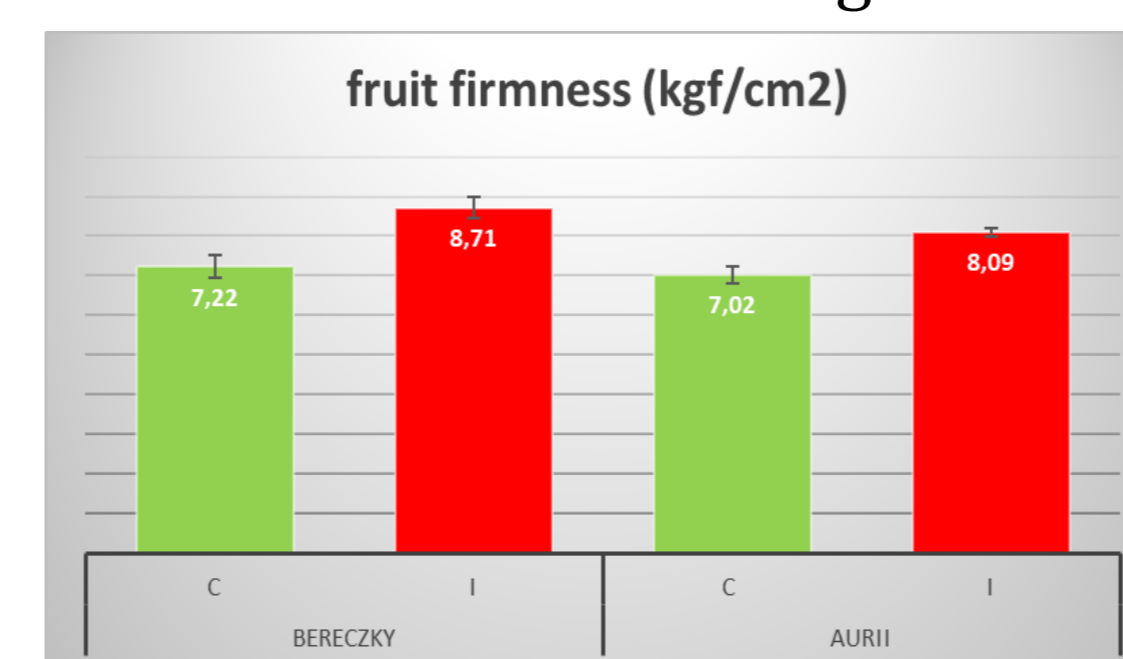


Fig.3. Fruit firmness in quince cultivars (c-control; i-infected)

Genotype	exp. var.	DW (%)	TSS (°Brix)	TA (%)	Maturity index (TSS/TA)
Bereczky	control	20.88 ± 1.06	16.36 ± 0.82	1.56 ± 0.04	10.50 ± 0.59
	infected	18.31 ± 1.81	16.90 ± 1.35	1.27 ± 0.05	13.38 ± 1.35
Aurii	control	22.13 ± 0.98	16.20 ± 1.90	1.54 ± 0.06	10.56 ± 1.54
	infected	18.78 ± 0.88	14.03 ± 0.57	1.25 ± 0.07	11.26 ± 0.24

The obtained results showed that natural infection with fire blight causes a reduction in the amounts of dry matter in fruits, most likely due to damage to the foliar apparatus of plants and inhibition of photosynthesis. The TSS was higher in infected fruits of the Breczky variety (16.90 ± 1.35 °Brix - infected and 16.36 ± 0.82 °Brix - control) and much lower in the case of infected fruits of the Aurii variety (14.03 ± 0.57 °Brix - infected and 16.20 ± 1.90 °Brix - control), and TA recorded lower values in juice extracted from infected fruits compared to control (1.56 ± 0.04 % - control / 1.27 ± 0.05 % - infected in Bereczky, respectively 1.54 ± 0.06 % - control / 1.25 ± 0.07 % - infected in Aurii).

• Conclusions

Fire blight impact on the main fruits quality traits in quince was extremely strong, causing a reduction in their mass and volume, with irreversible effect on commercial value. Also, this bacterial disease affects the main sensory features, through color changes of the pericarp, deformation and increased firmness by expanding petrified tissues in the fruit pulp.