LOSSES OF APPLE FRUIT (CV. CRIPPS PINK) CAUSED BY FUNGAL DISEASES DURING STORAGE

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INTRODUCTION

Apple is one of the most important fruit species worldwide as well as in Croatia. Prevalent cultivars grown in Croatia are Idared, Jonagold, Granny Smith and Golden Delicious but new ones are being introduced in production, such as Cripps Pink.

Apple fruits are stored after harvest in order to provide market with quality fruits yearlong. Fungal diseases occur regularly during storage and can cause severe yield and economic losses. During 1950s postharvest losses on apple fruits were up to 80%, even 90% (Anderson, 1956). In 2004 report was published suggesting that deterioration during storage caused 5 to 25% losses of total yield (Jijakli and Lepoivre, 2004).

The major postharvest pathogens of pome fruit according to literature are *Penicillium expansum* Link, *Botrytis cinerea* Pers.: Fr and *Monilinia fructigena* (Snowdon 1990, Ivić et al., 2009, Ivić et al., 2006; Trkulja 2008; Konstantinou et al., 2011). Other common fungal species isolated from rotten pome fruits are: *Colletotrichum*, *Mucor*, *Rhizopus*, *Alternaria*, *Botryosphaeria*, *Fusarium*, *Neofabraea* etc. (Konstantinou, 2011; Ivić et al., 2009; Snowdon, 1990).

Losses of apple fruit caused by fungal pathogens during storage are poorly investigated in Croatia. Therefore, a study was initiated to estimate losses due to postharvest diseases of apple cv. Cripps Pink and to determine causal agents of fungal diseases during storage.

Botrytis cinerea

Colletotrichum spp.

Fusarium spp.

Neofabrea spp.

Penicillium spp.

MATERIALS AND METHODS

Study was conducted in season 2009/2010. After harvest fruits cv. Cripps Pink from orchard situated near Vrgorac (Dalmatia) were stored in ULO (Ultra Low Oxygen) conditions at temperature 0,5 ° C, relative humidity 92%, oxygen concentration 1,5% and carbon dioxide 2%.

After two, five, seven and eight months of storage assessments of disease incidence and losses were done. One thousand of randomly selected fruits were examined from the selection line during the packing operation. Disease incidence was calculated based on number of symptomatic fruits out of the total number of examined fruits, and was expressed as a percentage. Economic loss was calculated by multiplying weight loss per one tone with average wholesale market price of one kg of apple for periods when assessments were done. Fruit weight loss per one tone was calculated on the basis of disease incidence, average fruit weight and number of fruits in one tone. Frequencies of pathogens among decayed Cripps Pink fruit were also calculated.

Symptomatic fruits were transported to the laboratory and fungal pathogens were determined based on symptoms and morphological characters of fruiting bodies and spores, according to descriptions of Snowdon (1990) and Crous et al. (2009). Parts of fruit tissue without visible sporulation were incubated at 22 °C in moist chamber for several days. After incubation fungal colonies were transferred to PDA (Potato Dextrose Agar) medium to obtain pure cultures, and subsequently fungal identification was done based on colony appearance and morphological features.

RESULTS AND DISCUSSION

During the season 2009/2010 disease incidence on apple fruit cv. Cripps Pink varied from 2,1% to 38,5%, and estimated economic loss ranged from 14,91 to 450,45 EUR/t of apple fruits (Table 1). After five and seven months of storage losses were relatively high, but consistent with previously published report suggesting that postharvest diseases cause 5 to 25% losses of total yield (Jijakli and Lepoivre, 2004). Losses after eight months of storage were very high, with disease incidence of 38,5% and estimated economic loss of 450,45 EUR/t. After two months of storage disease incidence was substantially lower (2,1%) and economic loss valued 14,91 EUR/t.

Table 1: Disease incidence and estimated economic loss of apple fruit cv. Cripps Pink during storage.

Months of storage	Disease incidence (%)	Yield loss (EUR/t)
2	2,1	14,91
5	11,1	87,69
7	17,7	205,32
8	38,5	450,45

Seven different fungal genera were determined in this experiment (Table 2). Dominant postharvest diseases were gray mold (*Botrytis cinerea*) and blue mold (*Penicillium* spp.), considered to be major postharvest pathogens of pome fruit (Snowdon 1990, Ivić et al 2009, Ivić et al 2006, Trkulja 2008, Konstantinou et al 2011). *Monilinia* spp., one of the prevalent fruit rot pathogens according to literature was not determined in this study. Nevertheless, *Neofabraea* spp. considered as a minor pathogen in previously mentioned studies, was determined as one of the major pathogens in our study, accounting for 24,1% average of the diseased fruit. Frequency of *Fusarium* spp. varied from 2,4 to 14,8% in all assessed periods. Other fungal genera *Colletotrichum*, *Botryosphaeria* and *Alternaria* were determined at lower frequencies of 0 to 6,6%.

Increase of yield and economic loss during storage was evident in the study. One of factors that contributed to such increase might be storage conditions in ULO chambers. Since cv. Cripps Pink is a newer apple variety grown in Croatia, ULO conditions that suit best for long time storage should be established. The other reason might be appearance of *Neofabraea* spp. in higher frequencies after five months of storage, since storage conditions prolong beginning of rotting caused by this fungus (Snowdon, 1990). Therefore, susceptibility of Cripps Pink variety to *Neofabraea* spp. should be evaluated.

Table 2: Frequency of fungal pathogens on apple fruit cv. Cripps Pink during storage (%).

Months	Frequency of fungal pathogens (%)						
	Neofabraea spp.	*Botrytis* spp.	*Penicillium* spp.	*Fusarium* spp.	*Botryosphaeria* spp.	*Alternaria* spp.	*Colletotrichum* spp.
2	15,4	49,8	27,3	3,5	4,0	0,0	0,0
5	28,2	31,9	31,4	3,2	5,3	0,0	0,0
7	27,2	54,2	9,6	2,4	0,0	6,6	0,0
8	25,6	42,6	12,8	14,8	0,0	0,0	4,2
Average	24,1	44,6	20,3	5,9	2,3	1,7	1,1

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