EVALUATION OF FLOWER BUDS FROST SUSCEPTIBILITY IN COMMERCIAL CHERRY CULTIVARS, UNDER 2009/2010 WINTER CONDITIONS

EVALUAREA REZISTENŢEI LA GER A MUGURILOR FLORIFERI LA SOIURILE COMERCIALE DE CIREŞ, ÎN CONDIŢIILE IERNII 2009/2010

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Abstract. *Study's aim was to evaluate the frost susceptibility and effect of low temperature on the viability of cherry flower buds in 15 cultivars, commercially grown in Romania and some other European countries, in 2009/2010 winter climatic conditions, when, recurrently and with a large amplitude between day/night, temperature descended below - 20°C, phenomenon which, by his severity, occurs with low frequency in the subcarpathian hilly area of Romania. To attain this goal Kordia, Summit, Newstar, Kristin, Decanca, Viscount, Van, Rivan, Daria, Ponoare, Superb, Rubin, Stella, 2D 28-31, Ferrovia cultivars, have been tested regarding their response to our agro-climatic and technological conditions, in the main fruit growing area of the country. Evaluation of the winter hardiness of flower buds shows the sensitivity of Decanca, Newstar, Kordia and partly Van cultivars to low temperature registered during the winter season. Data regarding percent of damaged flower buds at two high levels in tree canopy are presented.*

Key words: *Prunus avium*, cultivars, winter hardiness

Rezumat. *Studiul şi-a propus aprecierea sensibilităţii la ger şi a efectului temperaturilor scăzute asupra viabilităţii mugurilor floriferi de cireş, la 15 de soiuri din sortimentul comercial cultivat în România şi unele state europene, în condiţiile în care, în mod repetat şi cu mare amplitudine termică între zi/noapte, acestea au scăzut sub – 20°C , fenomen care, prin severitatea lui, se înregistrează cu frecvenţă redusă în zona dealurilor subcarpatice din România. Au fost evaluată comportarea soiurilor Kordia, Summit, Newstar, Kristin, Decanca, Viscount, Van, Rivan, Daria, Ponoare, Superb, Rubin, Stella, 2D 28-31, Ferrovia ca răspuns al acestora la condiţiile agro-climatice şi tehnologice specifice principalei zone de cultură a pomilor din ţară. Studiul a evidenţiat sensibilitatea soiurilor Decanca, Newstar, Kordia şi parţial Van la temperaturile scăzute înregistrate în iarnă. Sunt prezentate date privind determinarea procentului de muguri afectaţi, pe trei paliere de înălţime în coroana pomilor.*

Cuvinte cheie: *Prunus avium*, soiuri, rezistenţă la ger

INTRODUCTION

In Romania, commercial cherry growing represents 8% of total fruit growing surface being located in the hilly area, where are the most favorable agro-climatic conditions concurring to high, good quality crop obtaining. Even if Romanian total cherry yield represents about 7% (60,000 t/year; FAO, 2005),

export is fluctuated and limited. From many other reasons, one of the main motives was considered the outdated cultivar's assortment (Budan, 2000). Therefore, in order to improve this situation, in the last years, commercial cherry assortment was significantly changed by introduction of new autochthonous and especially foreign cultivars, which are supposed more suitable to exigencies of global market. But, to speed up this process, many foreign varieties have been imported as planting material in default of their previous agro-ecological adaptability probation to local agro-climatic conditions.

MATERIAL AND METHOD

To eliminate this lack of knowledge, at the Research Institute for Fruit Growing, Pitesti, was initiated a study to evaluate agro-ecological adaptability to local climatic environment of some new foreign varieties as Kordia, Summit, Newstar, Kristin, Decanca, Viscount, Ferrovia and 2D 28-31 comparative with some autochthonous or old, foreign cultivars as Daria, Ponoare, Superb, Rubin, Stella, Van and Rivan.

Experimental field was organized in the germplasm cherry ex situ collection, where each genotype are represented by 4-5 trees of 8-10 m high, grafted on mahaleb, spaced at 5X4.5m.

The main reason was to evaluate tolerance or susceptibility to local climatic stress factors, using the common evaluation methodology as is presented in Cherry Descriptor List (IPGRI) (Lipman, 1997). In this particular case, information concerning flower buds susceptibility to low winter temperature was recorded by examination of viability of internal primordial generative organs, in longitudinal and cross-sectioned buds, gathered from three canopy elevations (100 buds from each elevation), on February 28, 2010, when trees have been in the facultative dormancy period.

Study was accompanied by meteorological observation of the daily air temperature, humidity, wind, sunshine evolution.

Meteorological data for 2009-2010 periods were compared with a database stored in MS Office Excel, consisting of 41 years (1969-2009) daily values of meteorological parameters (Chitu, 2009). To provide more consistency in terms of statistical interpretations of the paper, the probability density function was tested (distribution of daily mean values around the monthly average or monthly averages specific to each year around the multiannual average values of the same month). To this reason we used specialized statistical tests Shapiro-Wilk and D'Agostino, computed with SPSS 14.0 statistical analysis program. Once the normality of the distribution was accepted instead of the meteorological parameters values, we used the probability of occurrence due to gain further information made by comparison with the entire set of values. To calculate the probability of average, monthly and annual values, NORMDIST function of Microsoft Office Excel 2007, was used.

RESULTS AND DISCUSSIONS

Preparing trees for dormancy period depended (in circumstances where the health of the foliar apparatus, in October, was good) by the evolution of meteorological factors specific to October 2009. In 2009 the length of the growing season was normal, the first frost occurring on October 15 (average date of first frost in Maracineni, Arges is October 18). Air temperature in October 2009 was higher than normal (the probability of recording lower values being

79.8% for mean temperatures and 89.5% for minimum): Minimum temperature of October 2009 was 6.5°C compared with normal value 4.8°C (1969-2009). Also sunshine duration was very small (probability 2%), being recorded only 90.5 hours in October 2009, versus 165.6 hours normal value. Meanwhile rainfall and air humidity were very high (98% probability for rainfall - 147.8 mm versus 45.5 mm normal value and 95% probability for air humidity).

These weather conditions characterized by low light intensity and high temperature and humidity were not so favorable for the accumulation and storage of carbohydrates in the multiannual organs tissues of fruit trees (roots, trunk and branches), extending the vegetation period and negatively impacting the resistance to severe frosts from the dormancy period.

The same warm and cloudy weather continued in November, switching then to the winter period generally characterized by maximum temperatures below normal values and high rainfall.

On this monthly background there were two periods with very low temperatures: the first on 21 and 22 December 2009 (figures 1 and 2) when trees were in deep dormancy period and the second on days 25 and 26 January (figures 3 and 4) the late period of over wintering stage.

In December (fig. 1) after the first 15 days of the month with higher mean and even minimum temperatures (93.6% minimum temperature probability for the first five day period and 94.6% for the second), with high rainfall (five day period probability between 73 and 95%) and cloudy days (probability between 4.9 and 9.6%), minimum temperatures suddenly dropped on 21 of December at -20°C outside the shelter and at -18°C in the shelter at 8 o'clock (Figure 2).

If on December 20 at 14 o'clock, temperature was positive (1°C), and at 23 o'clock already down below -10°C, after 3 o'clock (December 21) dropped below -15°C and has maintained under this value for 7 hours.

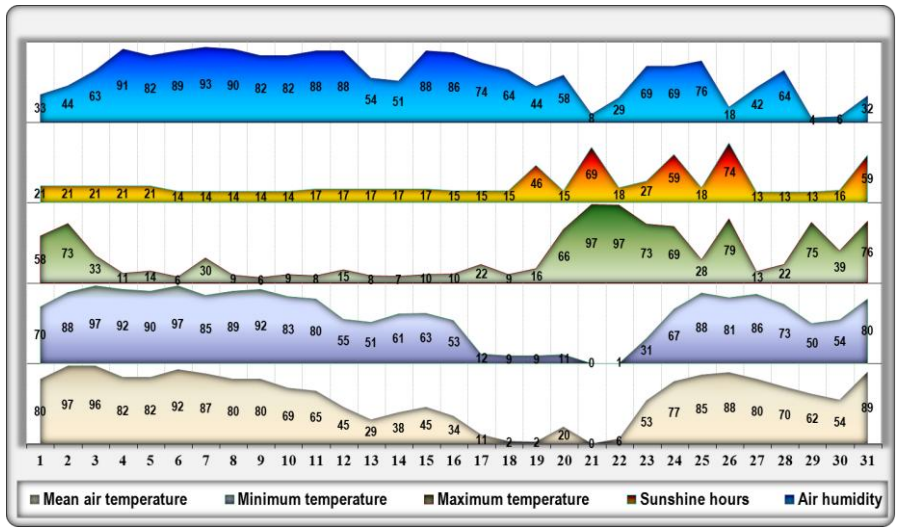

Fig. 1. The probability of recording daily values equal to or less than those occurring in December 2009 at Maracineni, Arges

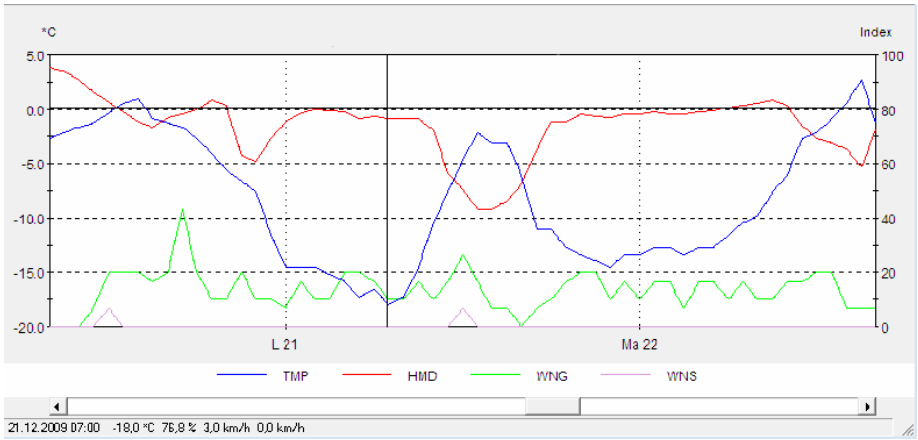

Fig. 2. The evolution of air temperature (TMP), humidity (HMD) and wind speed (WNS) on 21 and 22 of December, 2009 (Maracineni, Arges)

So in January 2010 the temperature dynamics were similar. After a first half of the month warmer than normal (probability of minimum temperatures of up to 95%, in nine days from 20 being over 80%) since January 21, temperatures dropped sharply and remained at this level for 8 days (figure 3). Lowest value was reported by January 25, 5 am, when the outside shelter temperature fell to -23.9°C, being only 0.5°C higher than the absolute minimum of the station (-24.4°C), and in the shelter at -22.6ºC (figure 4). On days 25 and 26 January the air temperature outside the meteorological shelter remained below the level of -20°C for about 24 hours. If the negative air temperature record of the station has not been exceeded, this happened, however, at snow level. Thus on December 26 the temperature from the surface of the snow dropped to -25.5°C, 0.7°C lower than the station record (1969-2010) dated January 5, 1993 (-24.8°C).

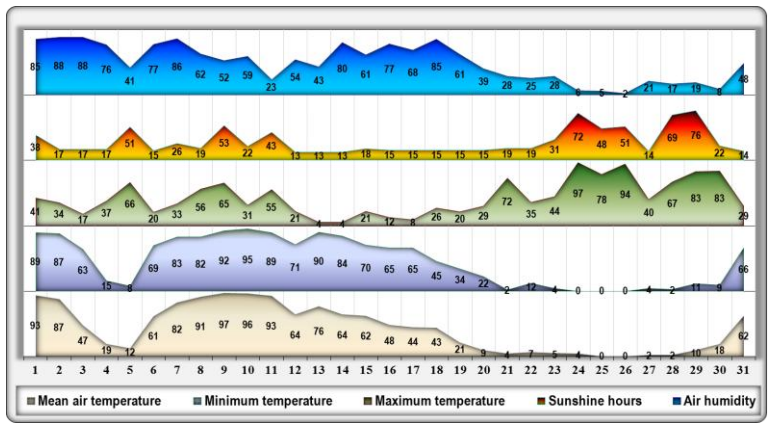

Fig. 3. The probability of recording daily values equal to or less than those occurring in January 2010 at Maracineni, Arges

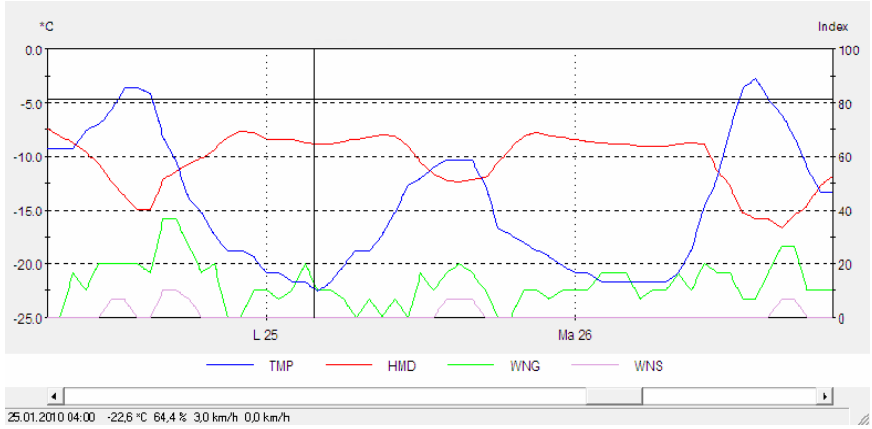

Fig. 4. The evolution of air temperature (TMP), humidity (HMD) and wind speed (WNS) on 25 and 26 of January, 2010 (Maracineni, Arges)

In this conditions every cultivars behaved oneself, according to their genetic background (table 1).

Table 1

Percent of demaged flower buds by low winter temperature at tree canopy levels

Current no.	Cultivar	Inferior canopy third	Medium canopy third	Upper canopy third	Average	Significance
1	Kordia	55	40	48	47,67	***
2	Rivan	7	3	2	4,0	ooo
3	Ponoare	21	6	5	10,67	ooo
4	Ferrovia	26	18	21	21,67	-
5	Summit	27	25	24	25,34	-
6	New Star	60	57	50	55,67	***
7	Decanca	76	70	73	73,0	***
8	Kristin	38	30	34	34,0	-
9	Van	41	37	39	39,0	**
10	Viscount	27	25	29	27,0	-
11	2D 28-31	40	30	35	35,0	*
12	Superb	1	0	0	0,33	ooo
13	Daria	21	17	19	19,0	oo
14	Rubin	20	19	20	19,67	o
15	Stella	10	5	9	8,0	ooo
	Media				28,01	
	Abatere standard				20,04	
	CV %				71,58	

DL 5% = 6,912; DL 1% = 9,318; DL 0,1% = 12,368

Damaging bud's degree varied in the large limits, from 0,33% (Superb cv.) to 73% (Decanca cv.).

Analyzing in ensemble obtained values, it can be observed that the low and upper canopy thirds were the most affected. If, in the first case, phenomenon is

justified by the air stratification according his density, cooler air being heavier, in the second case, explanation is the deficiency of phytosanitary protection of the top of the old, high, low spaced trees, caused by machine's technical limits. As a result, in the upper canopy, in the vegetative period, occurs a high infection by *Blumeriella jaapii* (Rehm.) Arx., lives fall early, in August, and buds preparing process for dormancy was made in the lack of carbohydrates accumulation. In this done situation, Decanca cv. with 73% damaged buds can be considered maladapted to climatic Romanian conditions. (fig. 5 and 6).

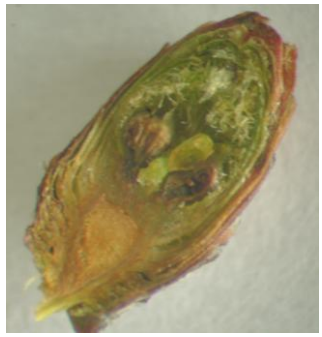

Fig. 5. Longitudinal section in a demaged by winter frost (Decanca cv.)

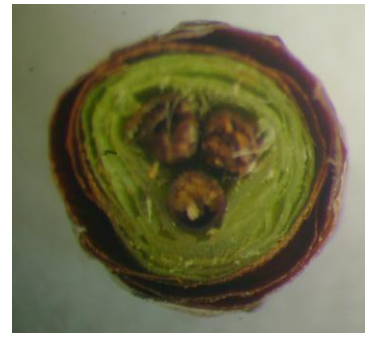

Fig. 6. Cross section in a flowerflower bud bud demaged by winter frost (Decanca cv.)

Newstar and Kordia cvs. have a serious risk to partly lose yield in severe, hard winters.

The less affected cultivars were Superb (0,33%), Rivan (4%), Stella (8%) and Ponoare (10,67%) which can be considered adapted to local, subcarpathion agro-climatic conditions.

Daria and Rubin cvs. released by autochthonous breeding program, confirm one more time, that the selection was properly made, in specific climatic conditions of Romanian cherry growing environment.

Ferrovia, Summit,Viscount and Kristin can be grown in Romania but it is necessary to pay a special attention to accurate choice of fair site for new orchard establishments, with diminishing risk of low temperature emergence or accumulation of cold air.

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