DOI: 10.22620/agrisci.2017.21.001

WINTER FROST DAMAGE IN CHERRY PLANTATIONS IN THE REGIONS OF PLOVDIV, SEVLIEVO AND KAZANLAK

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Abstract

In recent years the interest in cherry crops has increased, mostly for economic reasons. In some regions of the country there are significant variations of the minimum temperatures during the coldest months of the year, which inevitably has an impact on the productivity during the growing season of the cherry. Under these conditions and applying different technologies of cultivation, the varying susceptibility of the cultivars to minimum temperatures was observed. Similar trends in the susceptibility of the cultivars under the different conditions of the regions were observed. Out of the three investigated regions of the country (Kazanlak, Sevlievo and Plovdiv), significant damage to the fruit buds was found in the Plovdiv region. Several cultivars were tested. The *Ranna cherna* cultivar showed damage difference from 0 to 36% between the regions with only 4°C (-16 – -20°C) difference in temperature. The highest bud damage percentage was reported in the *Bing* (68%) and *Kossara* (60%) cultivars while the *Van* cultivar was defined as more resistant, with a maximum damage up to 20% in the different areas.

Keywords: cherry, cultivars, winter, frost, damage.

INTRODUCTION

Cherry is one of leading structural fruit species in the countries of the temperate climate zone (Faostat, 2015). It is a demanding type of fruit to the thermal regime of the habitat. According to Vassilev et al. (1982) and Georgiev et al. (2001) of the deciduous fruit trees it ranks in cold tolerance after apple, plum, cherry, and pear. According to the same authors winter frosts cause less damage to the cherry trees compared to late spring frosts.

Considering the threats arising from climate change, the establishment of orchards in investigated areas reduces the risk of damage during the winter and early spring, when fruit buds, flowers, and young fruit set are too sensitive to frost.

There is a need for a periodic and current data on climate situation and its impact on fruit crops.

MATERIAL AND METHODS

The studies were performed in the winter of 2016 - 2017, as the performed investigations were carried out in the period 27-31.01.2017 on the territory of the municipalities of Plovdiv, Sevlievo and Kazanlak. The subject is standard cherry cultivars grafted on seedling rootstock *P. mahaleb* and planted in private gardens, at 4-10 years of age.

After low temperatures have been reported, the percentage of low winter temperature injuries on flower buds was calculated by having reviewed 100 buds for each variant, taken from spurs situated on 2-year-old shoots 2 m above the ground (Nedev et al., 1979; Lichev and Papachatzis, 2006):

The results obtained are subjected to mathematical analysis using the method developed by David B. Duncan (Duncan, 1955; Harter, 1960). Software used in the study are "R-3.1.3" in combination with "RStudio-0.98" and installed package "Agricole 1.2-2" (Mendiburu, 2015).

RESULTS AND DISCUSSION

After the lowering of temperatures in winter period, 2016–2017 (Fig. 1 to 3) investigations of private orchards were conducted in the municipalities of Plovdiv, Sevlievo and Kazanlak (Figure 4).

From the graphics presented in Fig. 1, 2 and 3 it is apparent that the temperatures during the investigation fell below -15°C, which is a prerequisite for lowering the resistance of flower buds in the tested cultivars, especially when there is a variation in the amplitude of the air temperature

during January (Lichev and Papachatzis, 2006a, 2006b).

From the data for the frost damage, presented in Table. 1, it was established that with statistically proven resistance stands out the cultivar 'Van'. Observations show that the cultivar 'Van' in a greater degree tolerates adverse conditions in all observed areas compared to other cultivars.

During the reporting period, it is found that sensitive to low temperatures near Sevlievo are cultivars 'Kossara' and 'Ranna cherna'; near Kazanlak - cultivar 'Van' was affected; in the Plovdiv region with proven statistical difference and sensitivity to low winter temperatures differ cultivars 'Bing', 'Nalina' and 'Lapins'.

In the region of Plovdiv, low temperatures fell below and around -16°C even for a short time, which is a prerequisite for the highest percentage reported damage in nearly all tested cultivars. The majority of these damages were the partial freezing of differentiating flowers in the buds of fruit-bearing spurs.

In the area around Sevlievo, cultivars exhibit low sensitivity although the lower temperatures (down to -20°C), which is most likely due to the different habitat and breeding technologies, such as maintaining soil surface and training systems used to form the tree crown. These differences stand out most strongly in cultivar, 'Bing', taking into account the 68% damage in the Plovdiv region (at -16°C) (Figure 5), with grassed row spacings and compact crowns. While in Sevlievo area are recorded only 4% damage at temperatures of -21°C, as the soil surface in the plantation is maintained as fallow and tree formed as freestanding central leader trees. In cultivar 'Ranna cherna' were reported from 0 to 36% damage at a temperature difference of 4°C between the area of Sevlievo and Plovdiv.

Table 1. Sensitivity to low winter temperatures – winter season 2016–2017

Cultivar	Frost damage (%)		Region	GPS coordinates (WGS84)
Ranna cherna	36.0	ab	Batoshevo	42.9123091,25.0872803
Bigarreau Burlat	8.0	c	Damyanovo	42.9942739,24.9158340
Bing	4.0	cd	Damyanovo	42.9942739,24.9158337
Van	8.0	c	Damyanovo	42.9942739,24.9158339
Kordia	12.0	bc	Damyanovo	42.9942739,24.9158335
Kossara	60.0	a	Damyanovo	42.9942739,24.9158338
Rozalina	16.0	b	Damyanovo	42.9942739,24.9158336
Van	20.0	b	Sheinovo	42.6886816,25.3399658
Bigarreau Burlat	12.0	bc	Plovdiv	42.1040176,24.7193041
Bing	68.0	a	Plovdiv	42.1040176,24.7193033
Van	4.0	cd	Plovdiv	42.1040176,24.7193040
Kossara	16.0	b	Plovdiv	42.1040176,24.7193030
Lapins	56.0	a	Plovdiv	42.1040176,24.7193037
Nalina	60.0	a	Plovdiv	42.1040176,24.7193036
Rainier	15.8	b	Plovdiv	42.1040176,24.7193032
Rannacherna	0.0	d	Plovdiv	42.1040176,24.7193028
Regina	28.0	b	Plovdiv	42.1040176,24.7193038
Drogan's Yellow Bigarreau (Drogan's Gelbe Knorpelkirsche)	5.0	cd	Plovdiv	42.1040176,24.7193038

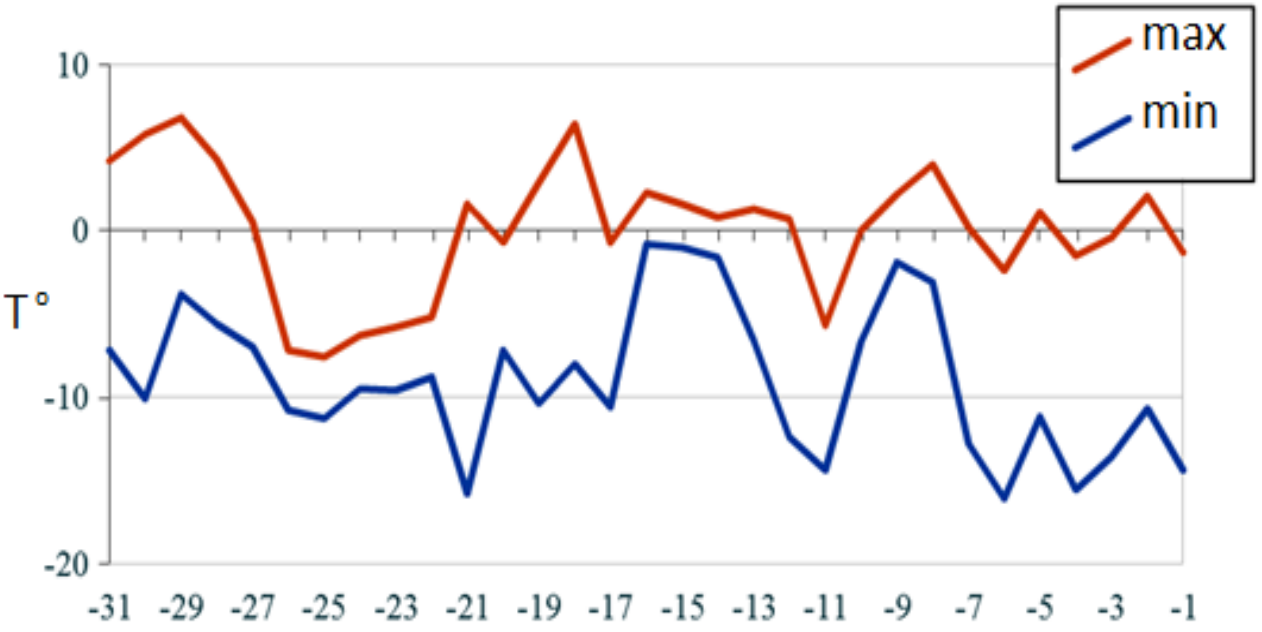

Fig. 1. *Temperature for the last 31 days for the Plovdiv region, reported on 31.01.2017*

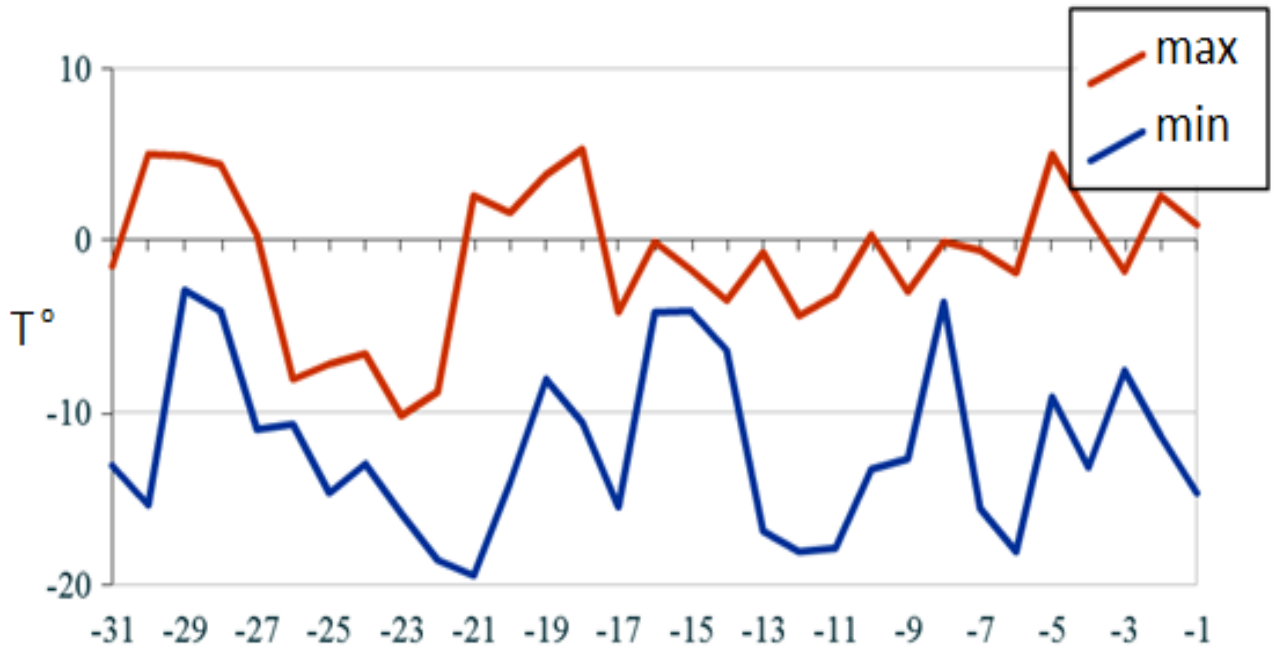

Fig. 2. *Temperature for the last 31 days for the Sevlievo region, reported on 31.01.2017*

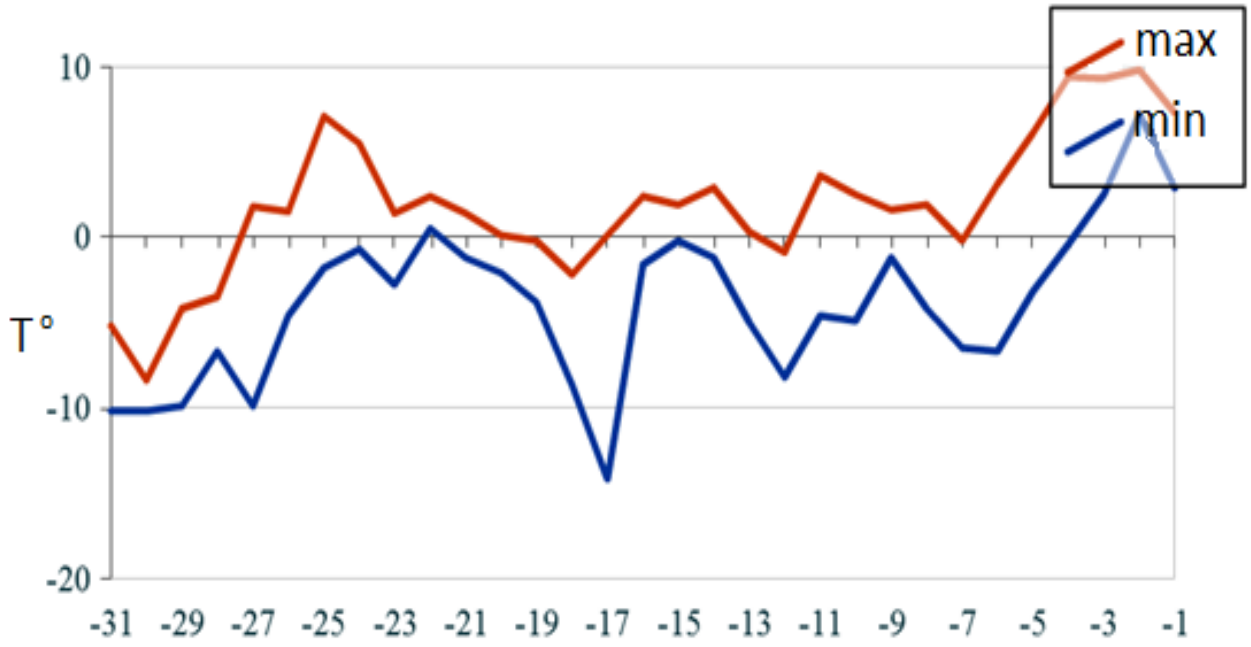

Fig. 3. *Temperature for the last 31 days for the Kazanlak region, reported on 31.01.2017*

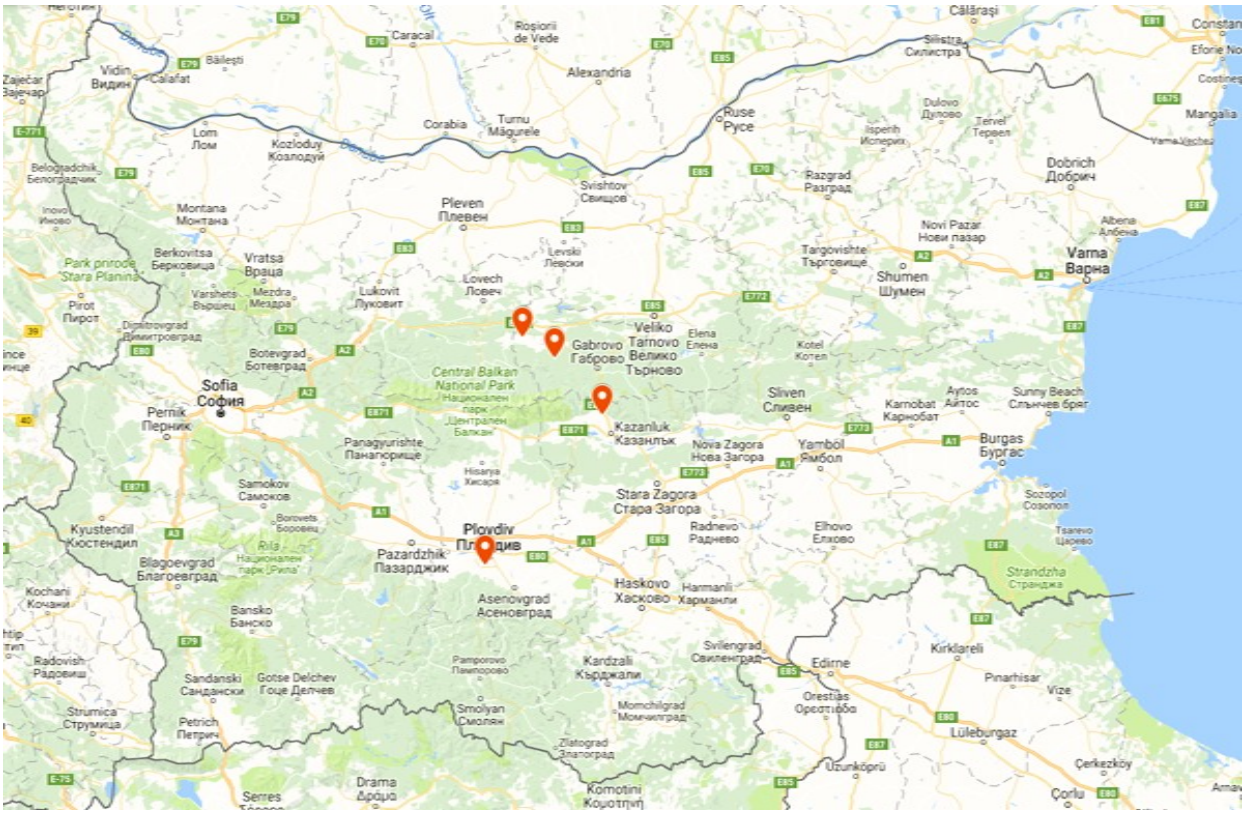

Fig. 4. *Investigations performed on 27-31.01.2017 on the territory of the municipalities of Plovdiv, Sevlievo and Kazanlak*

Fig. 5. *Partial freezing of differentiating flowers in the buds of cultivar 'Bing', caused by low winter temperatures*

The results show that the same cultivars have heavily damaged buds in all inspected areas, and the other permanent group exhibited a slight damage.

It is also evident that on the rate of frost damage, the influence of the habitat is significant. The most significant damage in the culture was established in the region of Plovdiv.

The data obtained for sensitivity to winter frosts of the standard cultivars 'Bigarreau Burlat', 'Bing' and 'Van' confirm the results of previous studies of Iliev et al, (1985), Vassilev et al, (1982) and Georgiev et al. (2001).

CONCLUSIONS

From the conducted research and the findings, the following conclusions can be drawn:

1. With the best cold tolerance of the tested cultivars excel 'Van' with partial freezing damage of differentiating flowers in the buds up to 20%.
2. A higher percentage of damage from winter frosts is reported in early blooming cultivars in all regions surveyed.
3. The areas are suitable for the cherry crop, but the use of cold resistant cultivars is recommended.

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