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RESEARCH ON GENETIC RESISTANCE OF THE 'ELMAR' APRICOT VARIETY AT LOW TEMPERATURES

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Abstract

The south-eastern part of Romania, especially the one of influence of the Constanta Fruit Resort, has faced in the last years with serious problems generated by the late and the return frosts. Late frost that occurred in spring affect apricot plantations, causing irregularities in the constancy of fruit production and their quality, gummy leaks and sensitivity of trees to the attack of apricot-specific pathogens. The research was conducted in an orchard of apricot aged 9 years, located at 18 km away from Constanta. Trees planted at a distance of 4x4m were studied during the vegetation season paying particular attention to resistance to low temperature. In the winter of 2017, temperatures decreased to -17 degree C and produced losses of flower buds. In the spring of 2018, the 'Elmar' variety bloomed well, 100% of flower buds being resistant to negative temperatures from winter. In 2019 was a warm winter but the temperature decreased in January to -17 degree C and the trees suffered a thermal shock. Following, resistance to frost decreased and the percentage of flower buds affected was 76.6%. In 2020 'Elmar' variety was not affected. In February of 2021 were, recorded temperatures of -16 degrees C associated with very cold wind, the flower buds were affected in 60%.

Key words*: thermal shock, temperatures, flower buds.*

INTRODUCTION

The apricot is a species appreciated for fruit quality and is grown successfully in areas with high temperatures (Cociu V. et al., 2000; Sestraș R. et al., 2004). In Romania, grows in the S - E part of the Dobrogea area. In this part, the apricot, do not make the fruits every year because of the low temperatures that affect the flowers (Braniște N. et al., 2007). The 'Elmar' is a new variety introduced in crop and after these studies this variety proves to us that it has a genetic resistance to low winter temperatures and temperatures during the flowering period. We made a trial with 'Elmar' variety to study resistance to winter cold, fructification and fruit quality. As a result of the researches, we were able to establish the resistance limit at low temperatures and we observed that the 'Elmar' variety behaves differently from one year to another depending on the evolution of the temperatures. In cold winters associated with wind, the productions are kept in relation to the warm winters. Researchers are concerned about obtaining apricot varieties that start late in vegetative and resist winter frost.

MATERIALS AND METHODS

The study was carried out in apricot demonstrative plots at Research Station for Fruit Growing Constanta, located in South-Eastern Romania, near the Black Sea. The site is located at 44°10' Northern latitude and 28°29' Eastern longitude, and 70 m above sea level. Climate is continental with warm and droughty summers, frequent dry winds all the year round and temperate winter generally without snow. The mean annual temperature is 12.0°C and the total active temperature is 3988°C, out of which 3170°C during the growing season; the annual precipitation amount is 400 mm, out of which during the growing season (April 1 to September 30), 240.7 mm. The lowest winter temperatures below -20°C are not very often: 1 out of 10-15

years and so are the spring frosts susceptible to cause apricot yield damage. The climatic water deficit reaches as much as 400 mm/year, so irrigation application is needed for apricot.

The zonal soil type is a calcaro-calcic chernozem formed on loess, with loam texture and a proper capacity of water preserving, holding and circulation. The humus content ranges between 2.5 and 4%; pH of the soil is poor alkaline (7.0-8.1).

There are twenty-four cultivars planted in demonstrative lots (4 m × 4 m scheme) in 2011 with North-South row orientation and the crown shape is improved vase. The apricot trees are grafted on 'Constanta 14' rootstock described by Indreias et al. (2010).

The agronomic and fruit-quality characteristics were evaluated four years (2018 to 2021).

The trees and fruit characteristics were evaluated according to the Methodology for trying new varieties of fruit trees, berries and rootstock in order to approve the homologation and International Union for the Protection of New Varieties of Plants (UPOV) guidelines.

To record the temperatures during winter and during the vegetation period we used our own meteorological data from the weather station.

During 2018-2021 the fruit yield was recorded starting with the 6th year after planting, when fruit production was considered stable. The average yield was evaluated by weighing the fruit of five apricot trees of each cultivar (kg/tree) and then as kg/ha. The fruits were weighed in the laboratory and analyzed for determinate the average fruit weight, color, pulp weight and kernel weight. The fructification pruning was made during the vegetative rest period. Soil has been kept clean by weeds by manual and mechanical work. To determine the percentage of buds affected by low winter temperatures, we made observations on the field. Observations were made in November (before frost), in February, at the beginning of the vegetative period (March) and during the vegetative period. After the flowering we determined the percentage of flowers formed to determine the influence of winter cold on fruit buds. During the vegetation period, we made observations on the percentage of fruit formed, the production of the fruit obtained and the qualities of the fruits.

RESULTS AND DISCUSSIONS

Research into the resistance of fruit buds to winter cold began in the winter of 2018 when the trees were 5 years old. In the spring of 2018 (Table 1) the apricot variety 'Elmar' was very little affected by the late frosts, thus a percentage of 94% of viable flowering buds was registered. The year 2018 was a normal year from the thermal point of view and the trees resisted very well during the winter.

Figure 1. 'Elmar' cv. Apricot

Figure 2. 'Elmar' cv. apricot

Table 1. Behavior of the 'Elmar' variety in the 2018-2021 period

Year	No. buds analyzed	% of viable fruit buds	% of affected buds
2018	311	94	6
2019	307	23.4	76.6
2020	290	97	3
2021	295	40	60
Average	300.75	63.6	36.40

In 2019 the winter temperatures varied a lot in very short periods of time, so if in January we recorded temperatures of -17^{0}C, in February we recorded days with temperatures above +12^{0}C, followed by temperatures of -7^{0}C in March. For this reason, the 'Elmar' apricot variety suffered, the flower buds were affected in a proportion of 76.6% according to Table 1.

Table 2. Fruits production and fruit characteristics at 'Elmar' cv. in 2018-2021 period

Year	Average fruit weight (g)	Weight of pulp (g)	Weight of stone (g)	Fruit production (kg/tree)
2018	49	46	3	22
2019	60	59	5	13
2020	53	50	3	21
2021	59	55	4	12
Average	55.25	52.5	3.75	17

In 2020, the 'Elmar' apricot variety was not affected by winter frosts, the variety having a good tolerance to thermal shocks (table 1). In 2021, from the analysis of the flower buds analyzed between January and February, we notice that the apricot variety 'Elmar' was 60% affected by the winter frosts and very little by the return frosts or late frosts.

Observations regarding the genetic resistance of flowers at low temperatures during bloom showed that the 'Elmar' variety very well tolerates low temperatures. In years with high production, when winter frost did not destroy fruit buds, and the temperature drop gradual the flowers were not affected by low temperatures during the flowering period.

In 2018 and 2020 during the bloom when the flowers were opened, during the night when temperatures were -1^0 ... -4^{0}C, the apricot flowers were not affected. The results regarding the influence of low temperatures on the percentage of fruits formed are presented in Table 2. The fruits were analyzed morphologically and was determined the production on the tree (Table 2). From the analyzed data we observe an average production during the four years of study of 17 kg/tree, which places this variety above the average production.

CONCLUSIONS

'Elmar' is constant in terms of fruiting, having good results even in unfavourable years for apricot cultivation. 'Elmar' variety is a relatively resistant variety to low winter temperatures and resistance depends on how low the temperature is. Under thermal shock, fruit buds can be affected to 60% to 80%, and warm winter's causes fruit bud losses. If the fruit buds are not affected during the winter, the 'Elmar' variety fructify normally, being resistant to low temperatures during the flowering period. It shows good plasticity to the accentuated climatic changes of the last years.

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