STUDY ON THE INFLUENCE OF CLIMATIC CONDITIONS DURING THE REST PERIOD UPON APRICOT TREES FRUCTIFICATION IN THE N-E OF ROMANIA

STUDIUL INFLUENȚEI CONDIȚIILOR CLIMATICE DIN PERIOADA DE REPAUS A POMILOR ASUPRA FRUCTIFICĂRII CAISULUI ÎN ZONA DE N-E ROMÂNIEI

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Abstract: *The winter resistance of apricot is the limiting factor for the culture expansion of this specie. This feature is determined not only by the singular effect of temperature (as lowered), but also winter condition evolution and plant's ability to adapt to higher temperature amplitudes, combined with the presence or lack of snow. Winter resistance is influenced by heredity factor, trees degree of hardening for winter, trees age, fluctuations in temperature during the winter, the land exhibition and the technology applied last year. Environmental conditions in the N-E area of Romania compromise apricot trees fructification in some years, due to very low temperatures but especially temperature fluctuations during the rest period. In this paper we present the situation during 2006-2007 and 2011-2012, when the total production was affected even at Umberto and Goldrich varieties that are known to have good resistance to frost, as compared to other varieties*
Key words: *apricot, winter resistance, production affected.*

Rezumat: *Rezistența la iernare a soiurilor de cais, constituie factorul limitativ, pentru extinderea culturii acestei specii. Această însuşire este determinată nu numai de efectul singular al temperaturii (cât mai coborâte), ci şi de mersul vremii din cursul iernii şi de capacitatea plantei de a se adapta la amplitudini mai mari ale temperaturii, combinată şi cu existența sau lipsa zăpezii. Rezistența la iernare este influențată de: factorul ereditar, gradul de călire al pomilor pentru iarnă; vârsta pomilor; oscilațiile de temperatură din cursul iernii; expoziția terenului şi tehnologia aplicată în anul precedent. În condițiile ecologice din zona de N-E a României datorită temperaturilor foarte scăzute dar în special a oscilațiilor de temperatură din timpul perioadei de repaus, compromit fructificarea caisului în unii ani. În lucrarea de față se prezintă situația din anii 2006-2007 şi 2011-2012., când producția a fost total afectată chiar şi la soiurile Umberto şi Goldrich, care au o rezistență bună la ger în comparație cu celelalte soiuri.*
Cuvinte cheie: *cais, rezistență la iernare, producție afectată*

INTRODUCTION

Apricot varieties winter resistance it's a limitative factor for culture expansion (Istrate and Rominger, 1995).

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This feature is determined not only of singular fact of lower temperatures but also of weather forecast during winter and plant capacity to adapt to higher amplitudes combined with snow presence or absence (Cociu et al., 1993).

Winter resistance is a complex concept and consists of:

- trees resistance at first frosts from the beginning of winter;
- trees resistance at lowest and prolonged temperatures during winter time;
- trees behaviour at low temperatures that comes after warmer periods from January and February, fact that drove to loosing the hardening and further looses.

Winter resistance is influenced by: hereditary factor, hardening level for winter, trees age, temperature oscillations during winter, field exposition and the technology applied the previous year (Istrate et al., 1996).

MATERIAL AND METHOD

Biological material consists of 3 apricot varieties grafted on *Armeniaca vulgaris* Lam. rootstock The experimental orchard was established in 1987 with 3.5x4 m plantation distances. It was used the pyramid crown.

There were made observations of the minimum temperatures evolution from trees rest period during 1993-1994; 1995-1996; 2006-2007 and 2011-2012 when were registered obvious deviations from multi-annual average. There were also made some observations of the varieties ecological adaptation capacity.

RESULTS AND DISCUSSIONS

Apricot culture limitative factor, for North-East part of the country is the temperature oscillations during winter that make flower buds to lose the resistance capacity at low temperatures and even their total loss at lower temperatures. During winter apricot resists to -20…-27°C if the applied agro technique assures a proper development and growing in the first part of the summer and a good wood maturation in the second part (Bodi and Dumitrescu, 1972).

The facts that amplifies frost effects are: trees important consumes after big harvests, tissues incomplete maturation, soil insufficient drainage, nutrients deficit or when some exceed, pests, late irrigations, trees vigour, inadequate pruning, temperature variations in a short interval, the stage when the frost comes (Bodi and Istrate, 1987).

Repose period is preceded by a nitrogen and phosphorous reserves migration from leaves to the other organs but also a hydro carbonate compounds migration. Trees suffer some changes at the end of the summer and during autumn in order to resist at winter frost. The hardening takes place under environment and internal factors influence, very similar in a way with those that determines the repose.

External factors are: the daily light decreases, the nights are colder, than follows temperatures below 0 until -5°C. Internal factors consist of multiple changes of protein substances, lipids, carbon hydrates, organic acids, amino acids, nucleic acids and growth regulators.

Depending on specie, temperature and ecological zone, trees may start the repose at the end of October or beginning of November. In rest period at fruit

growing species physiological processes are not very intense, thus there take place starch, oils and tannin accumulations.

Analyzing buds level of resistance we find that during October and November when temperatures are not too low, flower buds can resist up to -14°C. -20°C temperatures are lethal for buds. On the contrary, at the end of November and during December flower buds resist very well at -22….-25°C. At the end of this stage flower buds usually register the maximum winter frost resistance.

If in years with extremely mild winters, during November and December could be observed that floral primordial grow. In years with severe winter frosts that begins in December or even in November, there could be the risk that trees not to be ready to pass the winter so the buds and even the offshoots to be frozen.

This situation was noticed during trees rest period (1993-1994), when in November were pretty low temperatures (-18°C on 27th of November), apricot trees that were in profound repose were not affected by the frost (Fig. 1).

First bud burnishes were could be noticed after leaves fall down, especially when sudden frosts come, at the end of October and at the beginning of November, exactly how happened in Iasi in some years.

An exception from climatic point of view is winter 1995-1996, when were frequently registered negative temperatures for a period of six months. Minim absolute temperatures were -9°C (November, 1995), -16.3°C (December, 1995), -16°C (January, 1996), -19.4°C (February 1996). This drove to good trees hardening and implicit to a better winter resistance of the apricot varieties.

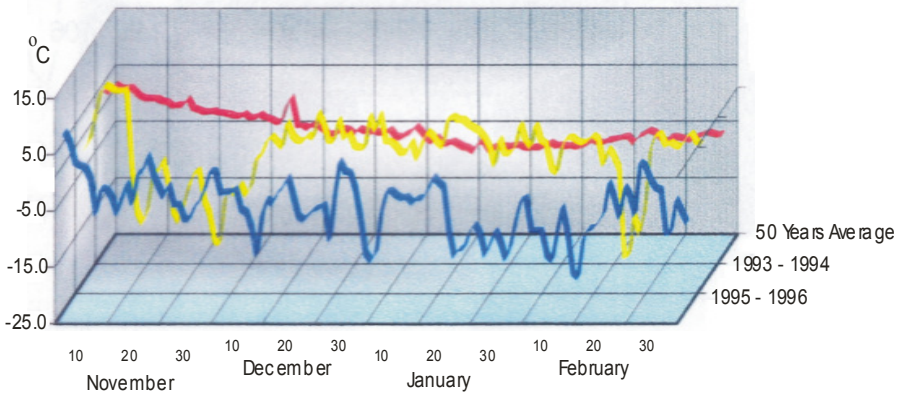

Fig. 1 - The evolution of minimum absolute temperatures during rest period in Iasi region

A better fruit tree plantations placement, depending on the favourability zone but also on temperature regime, choosing varieties resistant to the frost may diminish damages effects caused by winter frost. When environment temperature raises buds frost resistance lowers.

Big temperature oscillations during winter and especially at the end of winter, specific to our country (Iasi region particularly), lowers apricot winter resistance. In this way flower buds that passed through the winter and started vegetation may be affected by temperature of -13….-14°C (table 1).

Important damages were counted in February when after periods with positive temperatures from December and January came lower temperatures (-20,8°C) that destroyed completely the flower buds at all varieties.

Lower temperatures that come in February and March (when buds start their growing) affects flower buds or may provoke plagues on the tissues level of the branches. This period is characterized mainly by an intense increase of water content, fact that confirms buds transition from an obvious growing, more exactly cells elongation that is correlated with a bigger water inflow comparing with embryonic growth.

Buds total frosting registers specially in years when December, January and February are unusual warm, followed by sudden low temperatures at the end of February and the beginning of March. This situation was registered in Iasi, winter 2006-2007 (Fig. 2).

A similar situation was also recorded during the rest period 2011-2012, except that the period 25 January to 18 February minimum temperatures exceeded -13°C, with a maximum of -26.7°C (12 II). Buds loss due to the frost has a very characteristic aspect (Fig. 3). There could be noticed tissue burnish or only at the pistil base or of total floral parts.

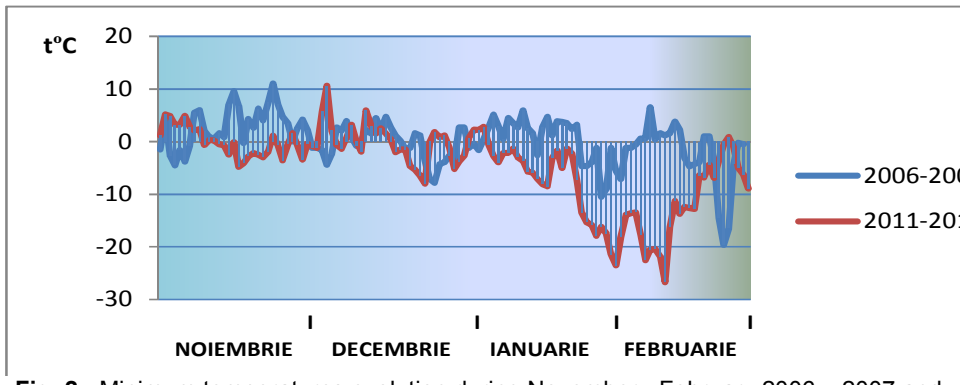

Fig. 2.- Minimum temperatures evolution during November - February 2006 – 2007 and 2011-2012.

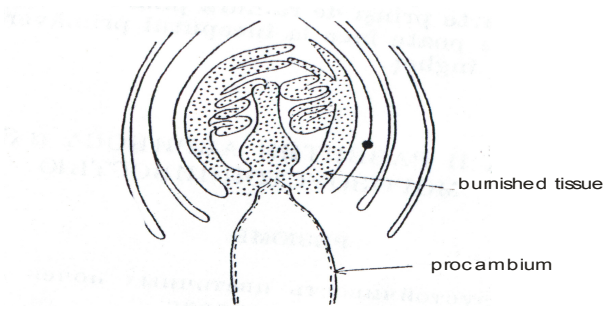

Fig. 3 - Apricot flower bud affected by -22°C temperature, in January

Table 1

Limits of low temperature resistance at apricot

Phenologic stage	Temperature °C		Predictable effects	
	Limits	Minimum registered	Minimum	Maximum
Deep winter rest period	Negative temperatures -25…-23°C	- 20…-23.9°C more than 2-3 days	6-90% frozen buds depending on the variety	Buds compete frozen and the loss of the harvest
Facultative winter rest	Temperature fluctuations +6…13.5°C	+16, -8…-16°C During a whole week	64-98% damaged buds	Flower buds and harvest total loss
		-21.6 block frost and 8 days ice	37-100% damaged buds	Flower buds and harvest total loss
The start of buds swelling	-13…-14°C	-7°C	40-60% frozen buds (good harvest)	80-90% damaged buds and harvest total loss
Buds swelling	-8…-9°C	-8°C	40-60% destroyed buds (economical harvest)	80-90% damaged buds, important harvest losses
Buds appearance	-7°C	-5.5°C	60-80% frozen buds	Buds and harvest total loss
The start of buds development	-3.9°C	-5°C	70-80% brown pistils, harvest decrease	100% of pistils are dark; harvest loss
Flowering	-2.2°C	-0.6…-3.2°C -3.5 …-5.5°C	90% of flowers are destroyed	100% of flowers are destroyed; harvest total loss
Petals fall	-3.2°C	-3.5…-5.5°C	70-80% of gynaecium are destroyed	Gynaecium is 100% dark; harvest loss
Young fruits development	-0.5°C 0.0…-1.5°C	1.0°C	Peduncles are frozen and 60% of fruits fall down	Fruits massive fall; harvest loss
Growing fruits	-1.0°C		fruits fall down 70% harvest decrease	Fruits massive fall; harvest loss
Trunk rest period	-28…-30°C			Tissue, bark and wood frozen

Buds sensibility, especially apricot, is bigger when they are in an advanced stage of development and also depends on their position on the crown tree. Thus, buts located on thick branches are much resistant than those placed on thin branches and the ones situated in the lower part of the crown are more affected by low temperatures comparing with ones from the top of the crown.

Short branches tissues and the bouquets are affected starting from down. More affected are the libber and cambium. Plagues provoked by winter frost at long branches are more reduced, mainly because the fact that the flower buds from these branches are late in development.

Apricot flower buds winter frost resistance is correlated with growing and development stages. At apricot buds with early differentiation during summer "grow old a little bit faster", being the fundamental cause of lower winter frost resistance in steppe conditions.

CONCLUSIONS

The North East region of Moldavia is suitable for apricot culture. The specie is drought resistant but it's located at the Nordic limit of culture for our country.

There are exceptions (once at 8-10 years), when because of temperature oscillations during winter as result of very low temperatures (-32.5^{o}C, winter 1962-1963), the production was compromised.

Unfavourable years for apricot culture in Iasi region were: 1962-1963, 1984-1985; 1993-1994; 2006-2007 and 2011-2012(3).

From all rootstocks used for apricot, peach give a reduced vigour and a better winter resistance comparing with *Armeniaca vulgaris* Lam. (2).

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