



THE FROST RESISTANCE OF VEGETATIVE PROPAGATED APPLE MOTHER TREE

Sohib Y. Islamov¹

¹*Department of Primary processing and keeping technology of agricultural products, Tashkent State Agrarian University, Tashkent-100140, University str., 3, Uzbekistan*

Abstract

The article presents the findings of the research on bringing out the features of an apple mother tree resistance to low temperatures in winter. It is found that only a seminal Seavers apple mother tree out of the tested vegetative propagated ones of East-Molling collection – MM101, MM104, MM105 and MM 106 is the most resistant to low temperatures.

Keywords – mother tree, frost resistance, overground part, root system, bud, shoot, rest, resistance, critical temperature.

I. INTRODUCTION

Winter damages of fruit-bearing plants are widely occurred in the industrial regions sometimes they occur on a mass scale and cause great losses to the national economy. It is found out that negative temperatures damage fruit-bearing plants in winter and while they change from winter to spring time. Increase of plants' resistance to this factor is achieved with selective method and choosing fruit-bearing mother trees. The present scientific work considers the resistance of mother trees to low temperatures in the deep rest time and in their awakening time [3, 4, 6].

II. MATERIALS AND METHODS

The 9 types of vegetative propagated apple mother tree of East-Molling and Molling-Merton collection and one type of seminal Seavers apple mother tree were used as the subjects of the research. The extent of the damaged branches and buds of each type of the mother trees was identified by placing the cuttings and shoots in a low freezing chamber of the fridge. To assess the stability the following features were taken into consideration: 0 – not frozen, 1 point – ¼ length of the cutting is frozen, 2 points – the whole length is heavily frozen, 3 points – 2/4 length is frozen, 4 points – ¾ of the cutting's length, 5 points – the whole length is frozen [1, 2, 5].

III. RESULTS AND DISCUSSION

In some years in Tashkent region the air temperature falls to – 30 – 32°C. At such low temperatures the damage of buds and shoots and also of the root system especially of the young mother trees in snowless winters are inevitable. Due to the above observing the extent of frost resistance of shoots, buds, stalks and root systems of the poor grown mother trees is of critical interest. Such researches were conducted in different periods of the rest time of the plants.

The table 1 shows that at -25°C the Seavers apple tree did not have any damages but the vegetative propagated mother trees have them of 8-20 points. As the most resistant to this temperature is MIX, MIII, MMVI types and less resistant are MM110 and MM105 ones. The temperature fall to -30°C also adversely affected the shoots of the tested trees but frost resistance of the poor grown mother trees' shoots in average reduced to 10 points. The shoots of MM110, MM106 and MM101 were less frost resistant at that temperature. The tested shoots of the Seaver apple tree were damaged for 17 points and of poor grown ones for 20-49 points. MM110, MM105 and MMVII have great damages.

Table 1. The frost resistance of the vegetative propagated mother trees while being in the deep rest and awakening

Types of the mother trees	The extent of resistance of shoots at different temperatures, %					
	January			3 rd decade of February		
	-25 °C	-30 °C	-32 °C	-20 °C	-25 °C	-30 °C
Seavers apple tree – tested sample	100	100	83	100	92	64
MIII	92	83	71	89	80	48
MVI	83	80	68	79	81	50
MVII	86	86	53	88	71	58
MIX	100	83	63	88	71	55
MM104	84	83	80	87	80	54
MM101	80	74	63	86	66	53
MM106	80	73	63	83	77	55
MM110	71	71	51	76	62	44
MM105	80	76	58	83	74	56

Thus, while being in the deep rest the shoots of the poor grown mother trees MVI, MIII, MIX and MM104 were the most frost resistant but MM110 and MM105 were less resistant ones.

While awakening time of the plants their frost resistance considerably reduced which is shown in the Table 1. At temperature of -20 °C the frost resistance of the vegetative propagated mother trees reduced for 15 points in comparison with the tested plants, at -25 °C – for 30 and at -30 °C – for 44 points. Especially, MV, MM101 and MM110 mother trees had heavy damages of their shoots at -30 °C. The shoots of these plants had damages of the wood, core and cambial cells for more than 50%. The necrosis of the cells (from brown to dark brown color) is another telltale of impossible recovery. This group of mother trees in the awakening time is found to be less frost resistant. MVI, MVII, MM105 and MM104 mother trees is found to be more resistant.

One of the effective indicators of the plants' frost resistance is the frost resistance degree of their stalks. The findings of frosting of the mother trees while the deep rest time are presented in **the table 2**.

The findings show that at -25 °C the number of the deceased stalks of the poor grown mother trees was comparatively not large, in average 18%, but in comparison with the testing one (Seavers apple tree) their loss was 2 times higher. At -30 °C the number of deceased buds increased to 25% or 6% more than Seavers apple tree did. At -32 °C a considerable number of stalks were lost – from 32 to 52% that comparatively in average for 7% more than the testing sample had. At this temperature the stalks of the mother trees MVII, MVI, MM105 and MM101 (42-52%) were more damaged.

While awakening time the frost resistance of the shoots reduced which is shown in the **table 2**. The stalks of the plants coming out of the deep rest were considerably damaged by not so heavy frost. For instance, at -20 °C the loss of the buds was from 17 to 36%, at -25 °C – from 32 to 64% and at -30 °C – 40-36%. In these conditions the mother trees MVI, MVII, M110 and MM105 were found to be poorly frost resistant.

Table 2. The frost resistance of the shoots of the vegetative propagated mother trees while the awakening time

Types of the mother trees	The frost resistance degree of the shoots at different temperatures, %					
	2 nd decade of February			3 rd decade of February		
	-20 °C	-25 °C	-30 °C	-25 °C	-30 °C	-32 °C
Seavers apple tree – tested sample	8	26	43	8	19	29
MIII	17	36	56	15	21	29

MVI	19	25	64	20	24	42
MVII	14	46	69	28	46	52
MIX	25	44	68	16	28	37
MM104	8	32	49	19	25	38
MM101	26	64	73	11	24	32
MM106	18	46	74	12	23	33
MM110	34	66	66	17	26	49
MM105	36	53	68	11	22	46

The frost resistance of the plants' root system is known as considerably weaker than their overground parts. It is damaged even at not so low temperatures. The poor grown mother trees' overgrown roots of up to 3mm diameter were considerably damaged that is seen from the data presented in the table 3.

The frost resistance of the apple mother trees' root system reduced with the temperature fall. Therefore, if at -6°C the roots' damage was not considerable (for 3-17 points) then at -9°C the degree of the damage of the roots reached 23 points. The heavy damages of the root system of the mother trees were occurred at -12°C (32-49 points)

Table 3. The frost resistance of the overgrown roots of the mother trees

Types of the mother trees	The frost resistance degree		
	-6°C	-9°C	-12°C
Seavers apple tree – tested sample	97	80	65
MIII	93	77	68
MVI	98	77	59
MVII	88	80	60
MIX	97	83	60
MM104	83	80	60
MM101	83	80	56
MM106	83	71	51
MM110	85	80	45
MM105	83	77	57

MM110, MM101, MM105 and MV mother trees were found to have less frost resistant roots. The loss of these mother trees' thin roots reached 40-50% that undoubtedly adversely affects the growth and total development of the plants.

Seavers apple tree's roots were more resistant to frost than the roots of the poor grown mother trees (in average for 10 points). It was found that the roots of MIII, MVII, MIX and MM104 types are more resistant to low temperatures. Thus, the root system and overground part of the tested poor grown mother trees of Molling-Merton collection are less frost resistant than those of the mother trees' group of East-Molling collection. This assertion should be taken into consideration when using them as mother trees for making a garden in colder regions of Uzbekistan.

IV. CONCLUSIONS

1. The highest frost resistance of the overground part of the apple mother tree to air low temperatures is observed in the period of the forced rest which is closely related to weakening of the activity of the plants' physiological processes.
2. The seminal Seavers apple tree of all the tested apple mother trees was distinguished with the most resistance to the winter temperatures (-25-30°C) and had almost not any damages of annual shoots in the forced rest time and only at biologically critical low temperatures (-32°C) 17% of the annual shoots were lost.

3. The vegetative propagated mother trees in comparison with the seminal mother tree – Seavers apple tree, had less resistance to low temperatures. In cold winter time at temperature -30°C to -32°C from 14% to 29% of overground part was damaged.
4. Such varieties as MVII, MIII, and MIX of East-Molling vegetative propagated apple mother trees collection proved to have the highest resistance to low temperatures and up to 86-100% of their shoots were in undamaged state. MM104, MM106, MM101 and MM105 of Molling-Merton mother tree collection had such features too.
5. While passing from winter rest time to the beginning of vegetation the vegetative propagated mother apple trees' frost resistance to low temperature (-20-25°C) sharply reduced due to activation of plants' physiological processes. The seminal Seavers apple mother tree reduced for 8% and vegetative propagated mother trees – for 20-29%.
6. The resistance of the mother trees' stalks in the period of the forced rest with the temperature fall of the environment from -25°C to 30°C reduced for 8-19% as the seminal Seavers apple mother tree did while the vegetative propagated mother trees for 11-25%.
7. In the period of activation of growth processes that is the plants' passing from the rest time to vegetation period, the growing buds become more sensitive to temperature fall. This time the loss of the buds is 8-36% at temperature -20°C and at -25°C the number of deceased buds increase for 1,5-2,5 times and make up 25-66%.
8. The separate parts of the root system, the overgrowing ones are more sensible to low temperatures. MVI, MVIII and MIX of East-Molling collection and MM101, MM104 and MM110 of Molling-Merton collection are more resistant to this factor. 88-97% of their overgrown roots are in active state at temperature fall to -6°C, at -9°C the number of deceased roots increases for 18-21,5 % and reaches 70,0-55,5%.

BIBLIOGRAPHY

- [1] Goutiyev G.T., Mosiyash A.T. The climate and frost resistance of subtropical plants. Gidrometeoizdat, 1968. -290 p (Russian).
- [2] The methodology of defining winter and frost resistance of fruit bearing trees and berries. Michourinsk, 1972. -83p (Russian).
- [3] Trusevich G.V. Intensive fruit growing. – Moscow: Rosselhozizdat, 1978. 49-56pp (Russian).
- [4] Trusevich G.V. The fruit-bearing mother trees. Moscow: Kolos, 1974. - 492p.
- [5] Tumanov I.I. The frost resistance of fruit-bearing trees.- Moscow: Kolos, 1963. 79-83pp (Russian).
- [6] Moyiseychenko V.F., Yeschenko V.Ye. The methodology of stock-taking and observation in experiments with fruit and berry crops. – Kiev, 1987. -20-21p (Russian).