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**Winter-resistance and durability of strange grades of an apple to spring frosts in conditions of Forest-steppe \***

**The purpose.** To determine winter-resistance and resistance to spring frosts of 14 strange grades of an apple of winter time of ripening in Forest-steppe of Ukraine.

**Methods.** Field, comparative, generalization.

**Results.** It is fixed that the investigated grades are characterized by average and above average level of resistance to conditions of overwintering, and reproductive organs of their trees have high resistance to spring frosts (-3, 1 °C).

**Conclusions.** Grades of apple Vilmut, Ligol and Fiesta have winter-hardiness which is above average level, and reproductive organs of trees of grades Askold, Vilmut, Graph Ezzo, Golden Delicious, Rainders, Pinova, Eliza, Jonagored and Ligol have high resistance to spring frosts.

**Key words:** grade, frost- and winter-resistance, level of resistance to low temperatures, resistance to spring frosts, reproductive organs.

Modern cultivars of apple cultivars in Ukraine are carried out with the introduction of introduced varieties of this crop. The basis of its sustainable regionalized assortment in our country is a wide range of winter-harvesting varieties, among which more than 60% are zoned in the steppe and are characterized by too long for the zone of the forest-steppe vegetation period [3]. In the northern regions of cultivation, they are not sufficiently adapted to a number of abiotic environmental factors. Literary review on the subject of studying the adaptation of apple varieties to the conditions of hibernation suggests that this property is studied mainly by scientists from the near abroad (Russia, Byelorussia) [1, 2]. Relevant information from Western European countries is not enough. In general, literary sources report the breeding and yield varieties [8 -10], therefore the definition of adaptability of new introduced varieties in the forest-steppe of Ukraine is relevant and requires a thorough study. The purpose of the research is to determine the winter resistance and resistance to spring frost of 14 introduced varieties of apple of the winter term of reaching the forest-steppe of Ukraine. Key words: varietal, frost and winter resistance, degree of resistance to low temperatures, resistance to spring frosts, reproductive organs. Research methodology. The laying of experiments, all records and observations were carried out in accordance with the "Program and method of sorting fruit, berry and nut tree crops" [4], field evaluation of winter resistance - to "Methods of conducting examination of varieties of fruits, berries, nuts and grapes" on a 9-point scale. [5]. Objects of research are 14 varieties of foreign and 1 domestic selection - Askolda (control). One-year-old trees on the subsoil 54 -118 planted in the garden of the primary variety study of the Institute of Horticulture of the National Academy of Sciences of Ukraine in the spring of 2001 under the scheme of 5 × 3 m, the crown shape - a spindle bush. The soil of the experimental site is dark gray, podzolized, medium argillaceous, on a carbonate forest, typical for the forest-steppe zone. The amount of humus in an arable layer is 20 cm - 1.9, mobile phosphorus - 19.8, exchangeable potassium - 8.9%, alkalinehydrolytic nitrogen - 8.2 mg / 100 g of soil, which is quite sufficient

for the cultivation of apple. The groundwater is located at a depth of 5 - 6 m. The climate of the region is moderately continental. Rainfall reaches 597 mm.

The long-term sum of active temperatures of 10°C and above is 2580°C, the average annual temperature of air - 5,8°C. During the study period (2005-2007 and 2011) weather conditions were characterized by instability. The sum of active temperatures of 10°C and above was 2882 (2006) - 3063°C (2011), rainfall - 521 (2007) - 728 mm (2005). Absolute minimum air temperature was -8.7 ° C (in February 2007) - - 32.2 ° C (in February 2006). Research results. Apple tree - one of the winter-resistant fruit crops [1]. This feature is an integral value, which depends on numerous internal and external factors: genetic features of the variety, its compatibility with the substrate, age and condition of plantations, level of agrotechnical care, methods of cutting, fertilization, etc. One of the main factors determining the degree of quenching of apple trees and, accordingly, its winter and frost resistance in the beginning of winter, is the weather conditions of the growing season, especially its second half [7]. In 2004, the growing season was characterized by a sufficient amount of precipitation (636.4 mm) and elevated temperature during the autumn. So, the average temperature in October was 9.0°C at a climatic norm of 7,6°C. Winter 2004 - 2005 was soft and snowy. In the first 2 months, the average monthly temperature was 0.4 ... -1.1 ° C, in particular the minimum temperature in February was -22 ° C. Frosts this month did not last long, but in March they were prolonged. In such conditions, the trees examined retained sufficient hardness during the flood and overwrought without signs of damage. During the growing season of 2005, there was a sufficient amount of precipitation. They were evenly distributed over time, the level of heat was normal, which contributed to the ripening of tissues gains and the satisfactory preparation of trees for winter hibernation. Winter 2005-2006 was an indication of the ability of introduced apple varieties to adapt to low negative temperatures. The average monthly temperatures in December and January were consistently higher than the average perennials. In February there were significant fluctuations of daily air temperatures. Frosts with a decrease in temperature to -28.5 ° C often changed with significant warming. The maximum temperature during thawing reached 7.8 ° C (second decade of February). The vegetative period of 2006 was characterized by very uneven moistening in the first half of summer, which provoked a wave-like increase in shoots of trees of the studied varieties. In the I-II decades of July there was a prolonged drought. Warm and drought was November this year. The average temperature of the moon was 3.1 ° C at a climatic norm of 1.4 ° C. Such weather conditions caused a delay in the preparation of the trees under study until hibernation. They came in the winter with rough edges of annual increments. This testifies to the lack of maturation of the latter and, consequently, the weakness of the trees as compared to their condition in the previous year. Winter 2006-2007 was characterized by a very high temperature for December - January. The warm weather lasted until the third decade of January, and the average daily temperature was increased to 6.9 ° C. In February, it dropped to -16.1 ... -17.6 ° C. It was then that a sufficient amount of snow was recorded (61.6 mm). In the vegetation period of 2010, an uneven distribution of precipitation and a fairly hot summer were observed (the maximum temperature in August reached 38 ° C). Sufficient rainfall in the second half of the autumn and high air temperatures delayed the preparation of trees for winter breeding. During the low winter winters of 2010 - 2011, long-term freezing frosts were recorded (minimum temperature -13.1 ° C), which did not damage the apple trees, and in the spring they were in good condition. In the winter period of 2005-2006, the air temperature dropped to -28.5 ° C during January-February, which contributed to an objective assessment of the winter resistance of introduced varieties. Under such conditions, in the majority of varieties, in particular in the Askold variety (control), a high degree of resistance of individual tissues of one-year increments was observed (table). The largest freezing (3.0 - 4.5 points) was caused by generative kidneys in the trees of the Alva, Golden Delights Reinders, Jonagold, Jonagored,

Decoste, Elise and Lodel. The average frost resistance of the kidneys (5-6 points) and the level with the Askold (k) variety revealed the Arlet, Vilmut, Graf Ezzo, Licol and Pilot varieties. In plants of Alva, Earl Ezzo, Golden Delicious Reyners, Jonagold, Jonagored, Pinova, Ligola and Fiesta, the core (at 3.0 - 4.5 points) of annual growths and fetus was significantly frozen.

*Winter stability and general condition of trees of introduced varieties of apple (2005-2006), IS NAAN*

Сорт	Ступінь стійкості тканин однорічних приростів і кльцівок до негативних температур, бал												Загальний ступінь підмерзання дерева		Загальний стан дерева восени	
	кора		деревина		бруньки		камбій		серцевина		кльцівки		бал			
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Аскольда (к)	9,0	9,0	9,0	9,0	9,0	5,0	9,0	9,0	9,0	6,5	9,0	4,0	0,0	1,0	9,0	8,0
Арлет	9,0	8,0	9,0	8,0	9,0	5,0	9,0	8,0	8,0	6,0	9,0	5,0	0,1	1,2	9,0	8,5
Алва	8,0	8,0	9,0	7,0	9,0	4,5	9,0	8,0	9,0	4,0	9,0	3,0	0,0	2,0	8,0	9,0
Вільмута	9,0	8,0	9,0	7,0	9,0	7,5	9,0	8,0	9,0	4,5	9,0	6,5	0,0	2,0	9,0	8,0
Граф Еззо	9,0	9,0	9,0	8,0	9,0	6,0	9,0	8,0	9,0	4,0	9,0	4,0	0,0	1,5	9,0	9,0
Голден Делішес																
Рейндерс	9,0	9,0	9,0	8,0	9,0	3,0	9,0	7,0	9,0	3,0	9,0	3,5	0,0	2,5	9,0	8,0
Джонаголд	9,0	9,0	9,0	8,0	9,0	4,0	9,0	7,0	7,0	3,5	9,0	3,5	1,0	1,0	8,0	8,0
Джонагоред	9,0	9,0	9,0	8,0	9,0	4,0	9,0	7,0	9,0	5,0	9,0	4,0	0,0	2,5	9,0	8,0
Декоста	9,0	9,0	9,0	8,0	8,0	4,0	9,0	8,0	9,0	6,0	9,0	8,0	0,0	1,0	9,0	8,0
Елізе	9,0	8,0	9,0	7,0	9,0	4,0	9,0	7,0	9,0	6,0	9,0	4,0	0,0	1,5	9,0	9,0
Лодел	9,0	8,0	9,0	9,0	9,0	3,0	9,0	8,0	9,0	6,0	9,0	3,5	0,0	1,2	9,0	8,5
Лігол	9,0	8,0	9,0	8,0	9,0	6,0	9,0	8,0	9,0	6,0	9,0	5,0	0,0	1,0	9,0	9,0
Пінова	9,0	9,0	9,0	9,0	8,0	7,0	8,0	8,0	8,0	4,5	8,0	7,0	0,0	0,0	9,0	9,0
Пілот	9,0	8,0	9,0	8,0	9,0	6,0	9,0	7,0	9,0	6,0	9,0	7,5	0,0	1,2	9,0	9,0
Фієста	9,0	9,0	9,0	9,0	9,0	7,0	9,0	9,0	9,0	4,5	9,0	9,0	0,0	1,5	9,0	9,0

Generative kidneys, rings and core of annual growth in trees of all other varieties were characterized by high or higher than average degrees of resistance to low temperatures (7-9 points). In the severe winter of 2005-2006, there was a significant freezing of the upper part of the annual growth in the trees of the varieties Arlet, Alva, Golden Delish Reinders, Graf Ezzo and Lodel. The wood was damaged by an average of 6.8 points. The most stable to cold conditions were annual growths of plants of the Askold (k), Vilmut, Ligol and Fiesta varieties. The stability of all tissues of these organs to low temperatures during hibernation was 7.8 points. The analysis of the average part of annual increments in the trees of the Askold (k), Jonagored, Decost, Pinova and Elise species showed that 10-15% of the generative kidneys were damaged by frost, and the rooting of their bases was observed. The low resistance of the reproductive organs to the conditions of hibernation in these years was characterized by the plants of the varieties Arlet, Alva, Jonagold, 40% of their kidneys were damaged by 3 points, resulting in yields in 2006 was very low (0.9 - 2.0 t / ha ) The stability of all other varieties was higher than average. The conditions for winter 2006-2007 and 2010-2011 all varieties withstood no significant damage, in the spring the total tree condition was estimated at 7.8 - 9.0 points. Significant damages to apple trees cause late frosts. During the flowering and planting of fruits, they often damage buds, flowers and young ovary. The temperature at which the first and second of these bodies die are respectively - 4 ... -6 ° C and -3 ... -4 ° C [6]. In 2005-2007, the phases of "pink bud" and "flowering" were not observed in the late-February frosts. Only in 2011, in the third decade of April, in the phenophase "pink bud" was recorded a decrease in air temperature to -3.1 ° C. Estimation of freezing of reproductive

organs in such conditions revealed damage (10 - 20%) of terminal flowers to trees of the varieties Alva, Arlet, Jonagold, Decosta, Lodel, Pilot and Fiesta. The high resistance of the buds to spring frosts (-3,1 ° C) consisted of Askold, Wilmut, Earl Ezzo, Golden Delishes Reinders, Pinova, Elise, Jonagored and Ligol.

### **Conclusions**

By studying the winter resistance of introduced varieties of apples by field method it became clear that in the forest-steppe of Ukraine their resistance to the complex conditions of hibernation is moderate. Plants of varieties Vilmut, Ligol and Fiesta are characterized by winter resistance, higher than average degree. The resistance to spring frosts (-3.1 ° C) of the reproductive organs in the trees of the Askold, Vilmut, Earl Ezzo, Golden Delishes Reinders, Pinova, Elise, Jonagored and Ligol species was established.

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