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IMPEDANȚA ȚESUTURILOR PRE-CAMBIALE CA INDICATOR AL COMPATIBILITĂŢII ȘI AFINITĂȚII PLANTELOR ÎN PEPINIERA POMICOLĂ

IMPEDANCE OF THE PRE-CAMBIAL TISSUES AS AN INDICATOR OF ADAPTABILITY AND AFFINITY OF PLANTS IN THE FRUIT NURSERY

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Abstract

The paper presents the results of the researches carried out regarding the assessment of growing cells and tissues resistance. Actively growing cells and tissues have resistance ranges between 400-1300 kom, and the pre-cambium complex of stress-damaged or incompatible vaccine tissues in the nursery - beyond 3300 kom. Field studies with a portable ohmmeter, (YX-360 TRD tester), with modified needle-type probes, allow a diagnostic assessment of the plants condition before the detection of visual signs of oppression from stress, or incompatibility in seedlings. The increase in ohmic resistance (impedance) to 4 kom is a signal of a decrease in adaptability and a disturbance in the metabolism of conducting structures. Large differences in the impedance readings in the grafting zone (budding) of the variety-rootstock combinations indicate to increased requirements for the plant care conditions in the nursery and for planting outside the nursery.

Cuvinte cheie: impedanță, compatibilitate, adaptabilitate, varietăți de portaltoi, pepiniera, Republica Moldova.
Key words: impedance, compatibility, adaptability, scion-rootstocks, tree nursery, Republic of Moldova.

1.INTRODUCTION

To successfully solve problems of production intensification of high-quality planting material, factors affecting its effectiveness should be taken into account: the adaptability, productivity and longevity of the grafted plants. At the same time, it is accepted to be guided by the concept of compatibility - the concept of the unity of the botanical relationship of the symbionts of the rootstock and the variety grafted, where plants of one botanical group can be ideal for this. A particular influence is manifested in the process of adaptation to the soil and climatic conditions of the environment and critical (stress) situations (Karasiov et al., 2011, Kușnirenco, 1979). Analysis of the papers devoted to the diagnosis of plant stress conditions showed that the most convenient experimentally and objectively reflecting features of the growth and development of woody plants is the pre-cambial complex of stem tissues whose anatomical and chemical properties can be estimated indirectly through their electrical resistance. Practical testing showed that between the thickness of the pre-cambial tissue complex and its electrical resistance, there is an inverse relationship, determined by the correlation ratio from 0.73 to 0.83 (Kușnirenco, 1979). The path of an electric current through a pre-cambial complex of healthy, damaged or physiologically incompatible graft tissues can be represented in the form of a model where the current-carrying elements are cells and intercellular spaces (Zhang, Willson, 1997).The newly formed wood consists of living, physiologically active cells with high electrical conductivity, while the electric current path through the elements of dead wood is possible only through bordered pores of tracheids. The latter is also characteristic of stress factors, among which a significant place is assigned to temperature, drought, soil conditions, and infection by viruses, pests and diseases (Dean, 1973, Vladeanu, Pattantyus, 2006).

2. MATERIAL AND METHODS

The researches were carried out during the year 2015 in the experimental field of the "Codru" Technology-Experimental Station. The application of this technique was done in the fruit nursery to assess the physiological status of various rootstocks of the grafted plants. The measurements were carried out with a standard tester (YX-360 TRD) with modified needle-type probes. On the plants without signs of growth disruptions, changes in color of leaves and wilting, the measurements were carried out once, on July 20-25. In plants with growth disruptionsdue a period of drought, particularly in clonal

rootstocks of stone fruit species, the electrical resistance was recorded again in 15 August. In the variety-rootstock combinations, the measurements were carried out in three terms: in May, July and August at 18-30 plants of the 2nd field of the Institute nursery.

3. RESULTS AND DISCUSSIONS

For a comparative diagnosis of drought resistance and monitoring of irrigation regimes, (Kushnirenko and Kurchatov, 1976) proposed the use of electrical resistance indicators for leaves. The authors proved that plants that lose less water during the period of drought (wilting) are characterized by a lower value of electrical resistance of tissues, and high resistance is ahead of the visual symptoms of oppression [2].

The application of this technique in the conditions of the fruit nursery allowed us to give a comparative description of the physiological status of various rootstocks in the mother plantations, as well as in the grafted plants. The measurements were carried out with a standard tester (YX-360 TRD) with modified needle-type probes (Figure 1).

Analysis of the obtained data showed significant deviations in different biotypes among clonal stocks. In the group of rootstocks with low resistance up to 500 kom, they entered in ascending order: D 69-135, M 9, EMLA, P 22, MM 106, Pi 80 and selections of MD institute.

The resistance from 500 - 1000 kom had M 26 (7-9 mm), quince BA 29 (7-9mm), R 14, and cherry plum seedlings of the Institute's collection fund.

Over 1000 kom for P 60, BA 29 (3-7 mm), and M 26 slips 9-12 mm. It is necessary to emphasize the exceptionally low resistance of the D 69-135 apple rootstock, (the morphological analogue 62-396), and a twofold increase in the resistance of the quince of VA-29 with a trunk diameter of 3-7 mm compared to the 7-9 mm diameter.

For rooted cuttings Kuban and Eureka, the impedance exceeded 1200 - 2900 kom, which puts them among the rootstocks with a risk factor for thermo-shock and drought (Table 1).

The same group included all clonal rootstocks of stone varieties. Many of them were on the verge of adaptability to the droughty conditions of the year, and the PiKu 1 cherry tree from Germany died 1.5 months later as a result of drying out; the remaining stocks are preserved. Also, they with stood with critical temperatures, the clonal rootstocks for plum VVA-1, Eureka 99 for peach, apricot, Gisela 6 (cherry, sour cherry) and Pumiselect (Table 2).

As regards the differences in the indicators, their large range can reflect both low adaptability to stress factors and a significant shoots quality variety within each parent plant.

It is assumed that the impedance parameters may have a wider aspect of diagnosing the physiological status of the cuttings when assessing their availability for root formation and incompatibility of the stock with the graft in the nursery (Karasiov, Karasiova, 2011, Dean, Evart, 1973, Stefano Mancuso, 1998, Vladeanu, Pattantyus, 2006).

It should be noted that the extreme air temperatures in the experimental area in July-August were 34-38°C in the daytime and did not fall below 26°C in the evening. In September, the peak of heat decreased and the plum and peach Eureka 99 and Pumiselect, as well as LC-52 and Gisela 6 rootstocksfor cherries and sour cherries recovered and were ready for budding.

A similar effect was exerted by dry periods on grafted plants in the nursery field, where incompatible rootstocks perished (Kabarda early / GF 305) or were far of normal development (Stark Sunglo / PG-2, Kabarda early / Wavit, Nadejda / Constanţa 16) (Table 3).

4. CONCLUSIONS

Using a portable ohmmeter (YX-360 TRD tester) with modified needle-type probes, it is possible to estimate the condition of the conducting tissues of rootstocks and grafted plants in a fruit nursery.

The increase in ohmic resistance (impedance) to 4 kom is a signal of a decrease in adaptability and a disturbance in the metabolism of conducting structures.

Large differences in the impedance readings in the grafting zone (budding) of the variety-rootstock combinations indicate to increased requirements for the plant care conditions in the nursery and for planting outside the nursery.

REFERENCES

1. Karasiov V.N., Karasiova M.A., Pasâncov D.A., Kovriga V.A., 2011. Oțenca prijivaemosti b sostoiania privoiev na lesosemennâh plantațiah sosnî obâcnovennoi po electricescomu soprotivleniu pastitelinîh tcanei. Оценка приживаемости и состояния привоев на лесосеменных плантациях сосны обыкновенной по электрическому сопротивлению растительных тканей. MarGTU, g.Joșkar Ola, Rossiiscaia Federația, s.35-38.

2. Kușnirenco M.D., Kurciatova G.P., 1979. Sposobî opredelenia srocov poliva i zasuhoutoicivosti plodovîh rastenii. Chișinău, ed. Știința, 1979, s. 23-30.
3. Dean R. Evart., 1973. Factors affecting electrical impedance of intermodal stem sestions.,PlantPhysi ology, p.478-480.
4. Stefano Mancuso, 1998. Seasonal dynamics of electrical impedance parameters in shoots and leaves relate to rooting ability of (*Olea europaea*) cuttings. Tree Physiology, Victoria, Canada, p.95-101.
5. Taper, C.D., Ling.,A. Hutchinson, 1997. Note on the estimation of apple rootstock vigor by the electrical conductivity of water extract. Canad. Journ. Plant.Sci., № 43. p.97.
6. Vladeanu D.C. Pattantyus C., 2006. Compatibilitatea unor soiuri de păr altoite pe gutui BN 70. Lucrări Şt. ale ICPP, Vol.XIII, p. 203-211.
7. Zhang M.I.N. and Willson J.H.M., 1997. Electrical impedance analysis in plant tissues. Canadian Journal of Forest Research, 27(9), p. 545-552.

Tables and figures

Table1. Impedance of the pre-cambial tissues of rootstocks in the mother plantation, 2015

Root, diameter of the stem	Impedance, [kom]	Root, diameter of the stem	Impedance, [kom]
Quince BA 29, slips7-9 mm	671	Pi 80 slips 7-9 mm	316
Quince BA 29, slips 3-7mm	1400	D 69-135 slips 7-9 mm	41
MM 106, slips 7-9 mm	428	P 22 slips 7-9 mm	148
M 26 slips 7-9 mm	650	P 14 slips 9-12 mm	916
M 26 slips 9-12 mm	1071	P 60 slips 9-12 mm	1015
M 26 Б slips 9-12 mm	1450	Cherry plum seedlings 9-12 mm	446
M IX EMLA slips 7-9 mm	185	Kuban 86	2972
MD slips 7-9 mm	454	Eureka 99	1250

Table 2.Impedance of pre-cambial tissues of various rootstocks of stone fruit species, (mother plantation, collection) 2015

Rootstocks	Measurements 21.07.2015, [kom]				Measurements 15.09.2015, [kom]		
	average	bounds	Range, [kom]		average	bounds	Range, [kom]
Kuban 86	2793	2317-3089	772		2380	2224-2589	365
Pumiselect	3127	2633-3583	950		1980	1507-2301	794
PiKu 1	3893	3300-4433	1133		***PLANTS THAT DIED***		
Eureka 99	2890	2233-3267	1034		1564	1060-2000	940
LC-52	2820	2417-3117	700		1588	1300-1840	540
Gisela 6	2696	2160-3140	980		1924	1520-2280	760
VVA-1	3170	2617-3383	766		2332	1680-2847	1167

Table 3.Impedance of the pre-cambial tissues between the stock and the grafted variety

Variety / rootstock	Measurement dates			Df, [kom]
	20. 05	20.07	20.08	
Kabarda early / Wavit*Plum*	875,0	1253,0	950,0	378,0
Kabarda early /GF 305 *Plum*	1275,0	*GRAFT SHOTS*		
ChachanskaNaibolia /GF305 *Plum*	438,7	585,7	285,7	300,0
Santa Maria / Pyrodwarf*Pear*	600,0	636,4	587,5	57,9
Santa Maria / Seedlings *Pear*	722,2	537,5	505,3	216,9
Collins / PG-3M *Peach*	500,0	550,0	463,6	86,4
Collins / T 16 *Peach*	478,6	620,0	550,4	141,4
Collins / GF 305 *Peach*	675,7	600,0	300,0	375,7
Stark Sunglo / T 16 *Nectarine*	490,9	681,8	366,7	315,1
Stark Sunglo / Sputnik (PG-2) *Nectarine*	**762,5**	654,5	507,7	254,8
Redgold / T 16 *Nectarine*	639,9	628,6	360,6	279,3
Nadejda / Constanţa 14 *Apricot*	627,3	745,5	387,5	358,0
Nadejda / Constanţa 16 *Apricot*	**928,6**	828,6	328,6	600,0
Nadejda / ZselMd (seedlings) *Apricot*	800,0	530,8	387,5	254,8
Almonds Meteor / GF 677	650,9	600,0	488,9	162,0
Rootstocks Sputnik PG-2 / GF 305	477,8	550,0	355,6	194,4

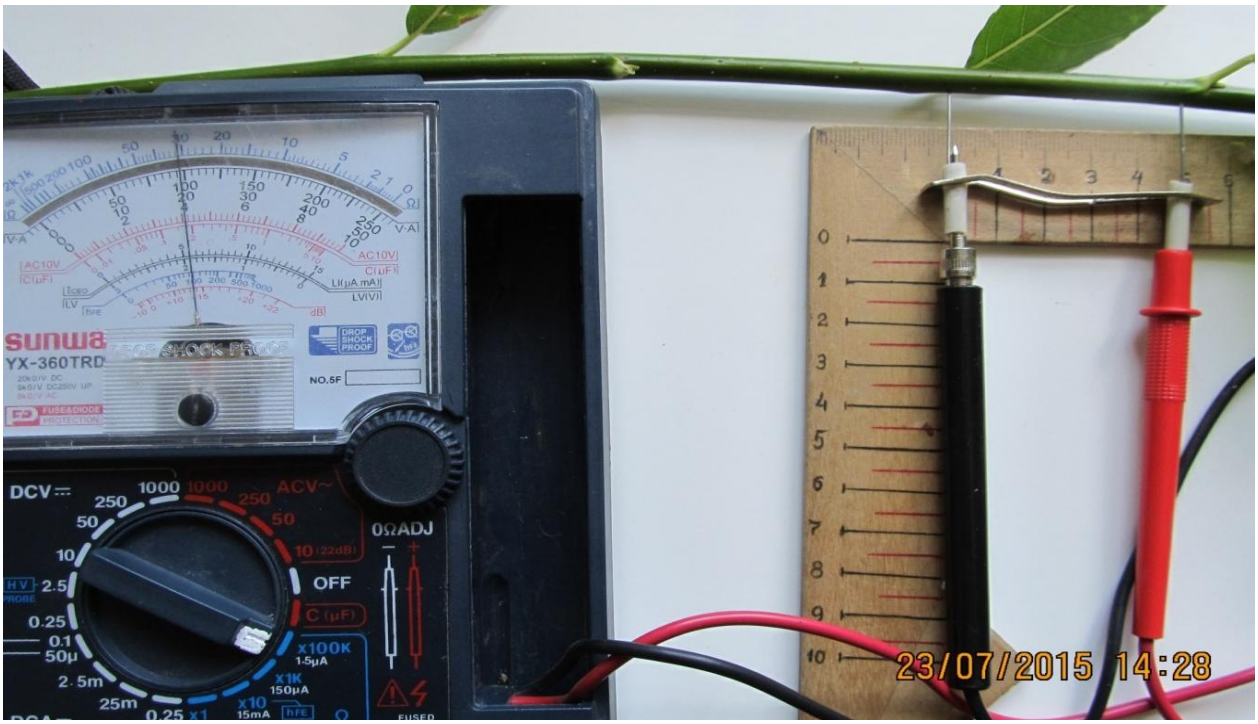

Fig.1. Measurement technique with needle-type probes