INCOMPATIBILITY ASPECTS THAT APPEAR IN SCION-ROOTSTOCK ASSOCIATION AT SOME PEAR AND PLUM VARIETIES

ASPECTE ALE INCOMPATIBILITĂȚII EVIDENȚIATE ÎN ASOCIAȚIA ALTOI-PORTALTOI, LA UNELE SOIURI DE PĂR ŞI PRUN

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Abstract: *It is known that fruit production is in a permanent interaction because of scion-rootstock association and because of this it is necessary to chose very carefully the varieties which have to be engrafted on the best rootstock adequate for the climatic zone where the new plantation will be set. The rootstock vigour has a very important role in variety's growing and fructification engrafted on it (4). This is why knowing the influences of physiological and biochemical processes upon association scion-rootstock has a major importance. Compatibility is a very important characteristic too because we could engraft a larger number of varieties on a compatible rootstock and this make it valuable.*

Key words: incompatibility, pear, plum, scion, rootstock.

Rezumat: *Este cunoscut faptul că producția este condiționată de permanenta interacțiune a asociației altoi-portaltoi şi datorită acestui fapt este necesar a se alege cu foarte mare atenție combinația soi-portaltoi cea mai bună la altoire. În acelaşi timp, este foarte important ca materialul săditor să fie bine adaptat la condițiile de mediu specifice zonelor unde se vor înființa noile plantații. Vigoarea portaltoiului este un alt aspect ce influențează vigoarea de creştere a soiului şi nivelul producției (4). Din acest considerent, cunoscând influența proceselor fiziologice şi biochimice asupra asociației altoi-portaltoi rezultatele cercetărilor proprii ne-ar putea furniza mai multe informații în acest domeniu. Compatibilitatea este, de asemenea, o caracteristică foarte importantă, deoarece ne permite altoirea unui număr foarte mare de soiuri pe un portaltoi cu care soiurile au o afinitate foarte bună, obținând astfel, un material foarte valoros.*

Cuvinte cheie: incompatibilitate, păr, prun, altoi, portaltoi.

INTRODUCTION

Plants photosynthetic activity is determined by complex physiologic processes and an important role in first stages of trees development have growth processes. While studying some physiological aspects of scion-rootstock association we find necessary to took into consideration some biometric parameters also. These allowed us to analyze the photosynthetic apparatus and also the whole plant.

The activity of photosynthetic apparatus depends on metabolism intensity of the whole plant, donor-receiver relations, and environment adaptation (7). And photosynthetic activity is influenced by many exo and endogenous factors which could change photosynthetic apparatus structure and functions. This could be a premise of cellular metabolism modification, of which intensity depend the biologic productivity (9).

The present studies aim some aspects of the relations between photosynthetic apparatus and plant vital metabolism. A special attention was given to the assimilators pigments. There were analyzed the relations between grafting success percentage, shoots growing and thickness morphological index of the grafting zone as results of a good activity of photosynthetic apparatus.

MATERIAL AND METHOD

The researches were made during 2004 – 2007 and there were studied some pear and plum varieties. Pear varieties are Curé, Euras, Contesa de Paris and Williams and plum varieties are Stanley, Pescăruş, Centenar and Tuleu gras. Grafting method used was T budding. For pear was used as rootstocks a selection of *Pyrus sativa Lam*. and *Cydonia oblonga Mill*. and for plum a selection of *Prunus domestica L*. and *Prunus cerasifera Ehrh*. The studies were carried out in Iasi, in V. Adamachi Experimental Farm of the Fruit Growing Department.

The aim was observing the behaviour of those varieties grafted on two different rootstocks. There were made biometrical measurements and was determined dry substance content (Somogy Nelson method) and assimilators pigments content (spectrophotometric method) (1). Grafting compatibility was evaluated by using the thickness morphological index of the grafting zone introduced by ICDP Piteşti Mărăcineni. The index is the ratio between scion transversal surface, rootstock transversal surface and grafting zone transversal surface. When the index has values higher than 0.33 varieties were appreciated as having very good compatibility, when the index is between 0.30 – 0.33 the compatibility is good and when the index is under 0.30 the compatibility is poor (2).

RESULTS AND DISCUSSIONS

Studying some growth and photosynthetic index at *Pyrus sp*. and *Prunus sp*. showed that those depends on variety biological characteristics and in the same proportion on rootstock used for grafting.

Table 1

Variety and rootstock mutual influence upon scion offshoot growth high

Variety	Rootstock	Scion offshoot **high** (cm)	Relative **high** (%)	± d (m)	Signification
Curé (control)	*Pyrus sativa* Lam.	142.20	-	-	-
Euras		156.50	110.0	+0.14	-
Countess of Paris		110.70	78.0	-0.31	0
Williams		102.30	72.0	-0.40	00
Curé	*Cydonia oblonga* Mill	102.00	72.0	-0.40	0
Euras		137.50	97.0	-0.05	-
Countess of Paris		77.00	54.0	-0.72	000
Williams		54.00	38.0	-0.88	000
DL 5% = 0.26		DL 1% = 0.36		DL 0.1% = 0.49	
Stanley (control)	*Prunus domestica* L.	131.00	-	-	-
Pescăruş		127.50	97.0	-0.04	-
Centenar		89.20	68.0	-0.42	000
Tuleu gras		87.70	67.0	-0.44	000
Stanley	*Prunus cerasifera* Ehrh.	143.50	110.0	+0.12	-
Pescăruş		133.00	102.0	+0.02	-
Centenar		67.60	52.0	-0.64	000
Tuleu gras		52.50	40.0	-0.79	000
DL 5% = 0.21		DL 1% = 0.29		DL 0.1% = 0.41	

The influence of scion-rootstock association upon the studied indexes is not the same, though; a moderate growth is in direct correlation with a good capacity of shoots formation, a medium trunk thickness, a balanced distribution of assimilates. All these show an optimum relation between root system and epigeous part.

Table 1 shows the biometric data of studied varieties depending on the used rootstock and variety and rootstock mutual influence upon scion offshoot growth high. As for the appreciation of varieties growth, grafted on two different rootstocks, this was made with the help of the biometric data concerning scion offshoot high, the thickness upper, under and in the joining zone. Using these data we could make some valuations of variety-rootstock mutual influence upon scion offshoot growing. Analyzing the offshoots growth high variation and the variety-rootstock mutual influence upon scion offshoot growing at studied pear varieties (comparing with the control, Curé variety grafted on a *Pyrus sativa* selection) we can see that this varied between 72 – 110% when varieties were grafted on *Pyrus* selection and 38 – 97% when *Cydonia* selection was used. The differences we found are statistically assured and there were very significative at Countess of Paris and Williams varieties grafted on *Cydonia* selection (table 1). At plum varieties we could observe the same negative influence on offshoot growth high at Centenar and Tuleu gras varieties. Concerning the grafting success percentage, there can be noticed differences between varieties grafted on the same rootstock and especially when there were used different rootstocks. And could be noticed varieties different compatibility when were grafted on those two rootstocks. Thus, Williams is the variety with the lowest grafting success, 69% grafted on *Pyrus sativa* and only 40% when grafted on *Cydonia oblonga*. At plum, Centenar and Tuleu gras registered the lowest grafting success percentage, 66 and 49%. Analizying table 1 we could also observe that low grafting percentage success correlates with reduced scion offshoot high.

Researches concerning the thickness morphological index of the grafting zone regarding symbionts anatomical resemblance allowed us to make some valuations upon grafting compatibility. In order to determinate this index there was measured rootstock diameter at ten centimetres under joining zone, scion diameter at ten centimetres upper the joining zone and the diameter measured in the joining area. After the measures were made in all 3 zones of the tree there were obtained interesting data which could explain better the scion-rootstock affinity phenomenon. From the researches with pear and plum varieties grafted on different rootstocks results that there is a direct correlation between the morphological index of the grafting zone and grafting success percentage. When the morphological index of the grafting zone has a small value, the grafting success percentage is also small and when the index's value is high the success percentage is also high.

Chlorophyll determinations were made using leaves from varieties and rootstocks, during the period of vegetation and they showed some content differences depending on the specie and variety genetic heritage (6).

In table 2 can be observed the result of dry substance determination in pear varieties leaves. Though, when grafted on *Pyrus* selection the varieties had a higher content of dry substance comparing with the variant when the varieties were grafted on quince. The biggest amounts of dry substance were accumulated by Curé and Euras varieties at both variants of grafting. The bigger differences on dry substance content that appear at the grafting on *P. cerasifera* of Centenar and Tuleu gras shows a reduced capacity of dry substance synthesis and a lower flow of glucides through grafting zone (table 5). Also, these varieties registered a lower accumulation in chlorophyll and carotenes pigments (figure 2) comparing with Stanley and Perscăruş varieties which showed a better compatibility at grafting on both rootstocks.

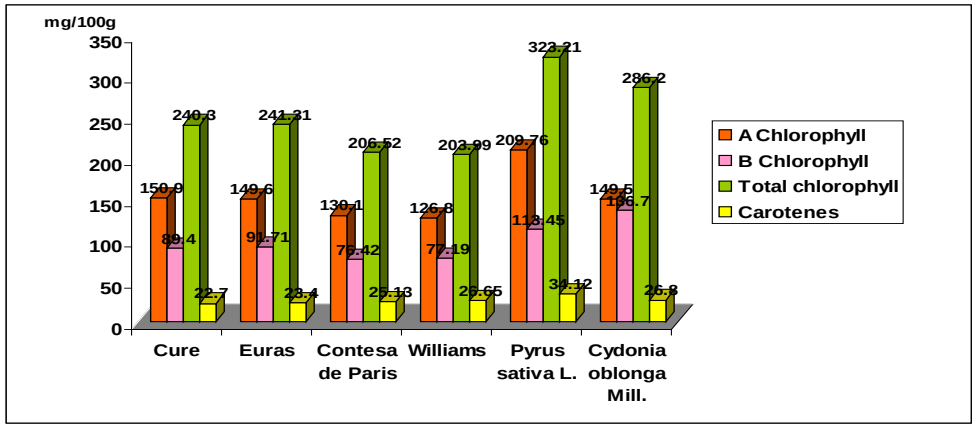

Fig. 1. Chlorophyll and carotenes pigments content of pear varieties and rootstocks used for grafting combinations (mg/100 g)

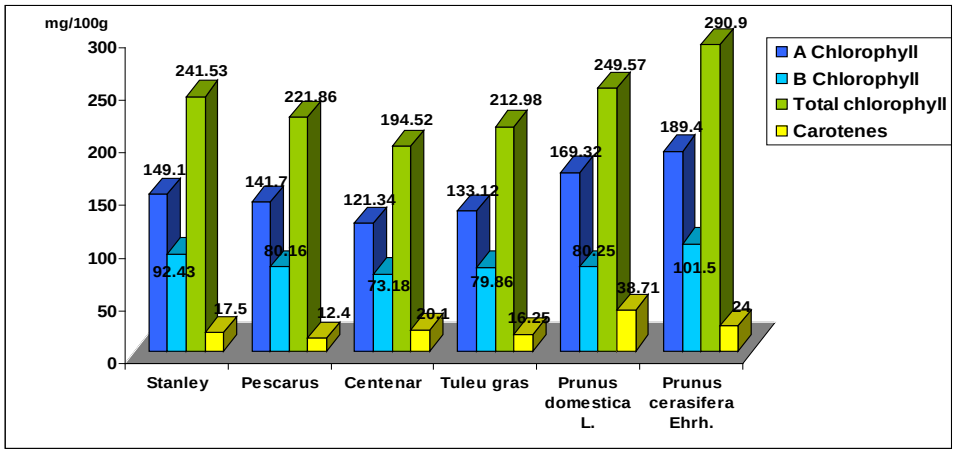

Fig. 2. Chlorophyll and carotenes pigments content of plum varieties and rootstocks used for grafting combinations (mg/100 g)

Table 2

Pear varieties dry substance

Variety	Rootstock	Dry substance (%)	Difference to the control	Signif.
Curé (control)	*Pyrus sativa* Lam.	57.89	-	-
Euras		57.58	-0.31	-
Countess of Paris		55.19	-2.70	0
Williams		54.27	-3.62	00
DL 5% = 2.67 DL 1% = 4.04 DL 0.1% = 6.49				
Curé	*Cydonia oblonga* Mill.	54.57	-3.32	-
Euras		54.61	-3.28	-
Countess of Paris		52.33	-5.56	0
Williams		50.31	-7.58	00
DL 5% = 4.43 DL 1% = 6.71 DL 0.1% = 10.78				

Table 3

Grafting zone morphologic evaluation of used pear varieties

Variety/Rootstock	Tree section area (cm^2)			Thickness difference between the scion and rootstock (cm^2)	The thickness morphological index of the grafting zone
	Upper the joining zone	Under the joining zone	In the joining zone area		
Curé/*Pyrus sativa Lam.*	1.36	1.78	2.18	0.40	0.41
Euras/ *Pyrus sativa Lam.*	1.24	1.49	1.78	0.25	0.46
Countess of Paris / *Pyrus sativa Lam.*	1.60	2.13	2.45	0.52	0.30
Williams/ *Pyrus sativa Lam.*	2.21	2.62	3.10	0.41	0.27
Curé/ *Cydonia oblonga Mill.*	0.60	1.16	1.43	0.56	0.36
Euras/ *Cydonia oblonga Mill.*	0.65	1.05	1.49	0.42	0.35
Countess of Paris / *Cydonia oblonga Mill.*	1.20	1.72	2.80	0.52	0.24
Williams/ *Cydonia oblonga Mill.*	2.77	3.29	4.04	0.52	0.20

Table 4

Grafting zone morphologic evaluation of used plum varieties

Variety/Rootstock	Tree section area (cm^2)			Thickness difference between the scion and rootstock (cm^2)	The thickness morphological index of the grafting zone
	Upper the joining zone	Under the joining zone	In the joining zone area		
Stanley/*Prunus domestica L.*	1.36	1.71	2.26	0.35	0.35
Pescăruş/*Prunus domestica L.*	0.88	1.26	1.71	0.38	0.40
Centenar/*Prunus domestica L.*	1.07	1.51	1.67	0.44	0.42
Tuleu gras/*Prunus domestica L.*	1.60	2.13	2.95	0.53	0.25
Stanley/*Prunus cerasifera Ehrh.*	1.28	1.81	2.34	0.53	0.30
Pescăruş/*Prunus cerasifera Ehrh.*	0.70	1.13	1.83	0.43	0.33
Centenar/*Prunus cerasifera Ehrh.*	0.55	1.15	1.98	0.60	0.24
Tuleu gras/*Prunus cerasifera Ehrh.*	0.58	1.30	1.93	0.72	0.23

Table 5

Plum varieties dry substance

Variety	Rootstock	Dry substance (%)	Difference to the control	Signif.
Stanley (control)	*Prunus domestica* L.	55.26	-	-
Pescăruş		55.63	+0.37	-
Centenar		49.54	-5.72	0
Tuleu gras		50.32	-4.94	0
DL 5% = 4.94 DL 1% = 7.49 DL 0.1% = 12.03				
Stanley	*Prunus cerasifera* Ehrh.	53.73	-1.53	0
Pescăruş		52.82	-2.44	0
Centenar		43.92	-11.34	00
Tuleu gras		44.84	-10.42	00
DL 5% = 4.97 DL 1% = 7.53 DL 0.1% = 12.09				

CONCLUSIONS

The lack of affinity of incompatible associations could be observed by: localized forms of incompatibility, in the joining zone; lower percentage of grafting success; lower value of thickness morphological index of the grafting zone; the accumulation of big quantities of dry substance above joining zone.

Leaves content in dry substance is correlated with varieties and rootstocks synthesis potential (chlorophyll and carotenes pigments).

At the associations with poor compatibility and poor joining (Centenar/*Prunus cerasifera*, Williams/*Cydonia oblonga*) could be noticed a significant lower content in dry substance comparing with trees that had a normal development.

The disturbances that appear in assimilated circulation are the result of a low development of roots and glucides stagnation above joining line, fact that determines the scion growing in diameter and also the joining zone at incompatible associations or with a poor compatibility.

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