GRAFT INCOMPATIBILITY IN PEAR: PHYSIOLOGICAL AND BIOCHEMICAL ASPECTS

INCOMPATIBILITATEA LA ALTOIRE A PĂRULUI: ASPECTE FIZIOLOGICE ŞI BIOCHIMICE

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Abstract: *The rootstock vigour has a very important role in variety's growing and fructification engrafted on it. This is why knowing the influences of physiological and biochemical processes upon association scion-rootstock has a major importance. The growth of scions and rootstocks of compatible and incompatible pear/quince grafts was compared. Present studies aim some aspects of the relations between photosynthetic apparatus and plant vital metabolism. A special attention was given to the assimilators pigments and the enzymes activity. 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. The activity of peroxidases was analyzed in both parts of the graft (scion and rootstock) to differentiate between the involvements of each in graft formation.*

Rezumat. *Vigoarea portaltoiului are o deosebită importanţă în creşterea şi fructificarea soiurilor altoite, de aceea, cunoaşterea influenţei proceselor fiziologice şi biochimice asupra asociaţiei altoi-portaltoi este prioritară în producerea materialului săditor. În această lucrare s-au comparat aspectele legate de creştere la altoii şi portaltoii asociaţiilor compatibile şi incompatibile păr-gutui. Obiectivul principal al studiilor efectuate a fost studiul relaţiilor dintre aparatul fotosintetic şi metabolismul pomilor altoiţi, o deosebită atenţie acordându-se pigmenţilor asimilatori şi activităţii enzimelor antioxidante. Au fost studiate relaţiile dintre procentul de prindere la altoire, creşterea lăstarilor, indicele morfologic de ingroşare în zona de altoire, ceea ce arată o bună activitate a aparatului fotosintetic. Activitatea peroxidazei a foast determinată în trei puncte ale zonei de altoire şi au fost analizate implicaţiile sale în prinderea la altoire.*

In the present work the structural development of the graft union formation is studied in pear, together with the possible relationship with peroroxidases activities. From cited literature results that the majority of the researches vote for incompatibility biochemical theory (2, 5).

MATERIAL AND METHOD

Researches were performed during 2005 – 2007 and there were studied some pear varieties behaviour grafted on different rootstocks. The following varieties were used: Curé, Euras, Comptesse de Paris and Williams. The grafting method used was T budding and the four varieties were grafted on *Pyrus sativa Lam*. and *Cydonia oblonga Mill*.

There were made biometrical measurements twice during the vegetation period and was determined glucides and proteins weight in three different zones: above the joining zone (A), in the joining zone (B) and under the joining zone (C). Peroxidases activity was determined also in those three different zones, spectrofotometrically by following the increase in absorbance at 470 nm. Chlorophyll pigment content of the scions and rootstocks was determined spectrophotometricaly (1).

The statistical analysis of obtained data was carried out using a two-factorial analysis of variance and limit differences.

RESULTS AND DISCUSSIONS

At fruit growing species planting material obtained by layering or by seeds there were observed a more uniform proteins and glucides content distributed all through the stem comparing with grafted plants. Proteins and glucides accumulation in different parts of the stem is more or less uniform and this is determined by grafting and simbionts compatibility.

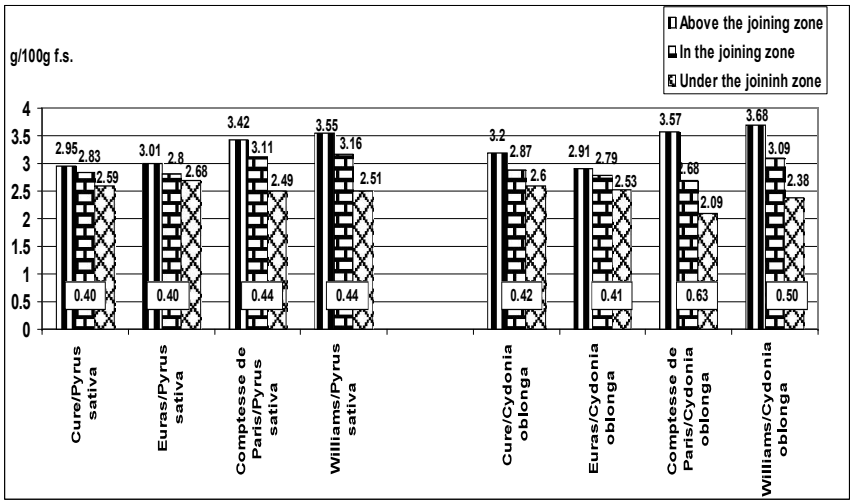

Fig. 1. Glucides determined in pear varieties leaves

The ratios between glucides accumulation determined in those three different zones (A, B, C) are reported in figure 1. As the ratio between the values of A, B, C zones is lower; the combination variety/rootstock has better affinity. When the ratio has a high value, the variety has a reduced compatibility with the used rootstock.

It was obvious the fact that under the joining zone the average glucides content was 1.17 times lower than in the joining zone and 1.32 lower than above the joining zone.

As for the glucides, proteins were present in higher quantities above the joining zone (table 1).

Proteins accumulation in a higher quantity at scion bottom (far from grafting zone) is due to a reduced connection between xylem tissues of those two partners and exudates formation highly concentrated in protein substances (4).

The analyses concerning pear varieties protein content performed above the joining zone showed that the rootstock influence the accumulation. The higher accumulation was registered at Comptesse de Paris 3.91 g/100g fresh substance in both cases of grafting (for both rootstocks). The lower accumulation were in case of Euras variety grafted on pear (2.73 g/100 g fresh substance) and Williams grafted on quince (2.19 g/100g fresh substance) (table 1.).

Proteins determined in rootstock (under the joining zone) were in lower quantities comparing with the other zones we analyzed.

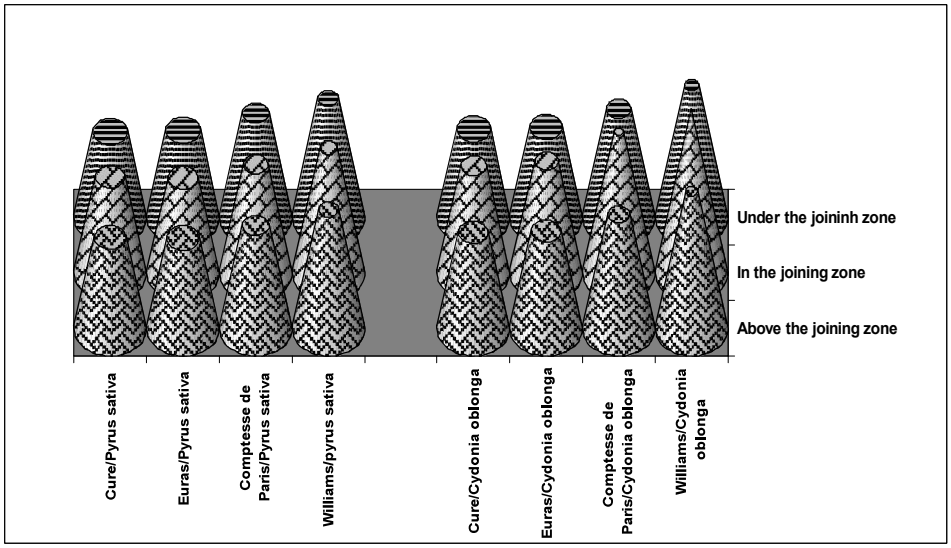

Fig. 2. The intensity of peroxidase activity

Table 1.

Proteins determined in pear varieties

Variety	Rootstock	Proteins (g/100g f.s.)	Difference to the control	Signif.
Above the joining zone				
Curé (Mt)	*Pyrus sativa Lam.*	4.03	-	-
Euras		3.15	-0.88	00
Contesa de Paris		4.17	+0.14	
Williams		3.61	-0.42	
Curé	*Cydonia oblonga Mill*	3.62	-0.41	
Euras		3.38	-0.65	0
Comptesse de Paris		5.23	+1.20	xxx
Williams		3.67	-0.36	

DL 5% = 0.60 DL 1% = 0.83 DL 0.1% = 1.15 g/100g f.s.

In the joining zone				
Curé (Mt)	*Pyrus sativa Lam.*	3.68	-	
Euras		2.73	-0.95	
Contesa de Paris		3.91	+0.23	
Williams		3.28	-0.40	
Curé	*Cydonia oblonga Mill*	3.22	-0.46	
Euras		3.21	-0.47	
Comptesse de Paris		3.91	+0.23	
Williams		2.19	-1.49	00

DL 5% = 1.07 DL 1% = 1.49 DL 0.1% = 2.07 g/100g f.s.

Under the joining zone				
Curé (Mt)	*Pyrus sativa Lam.*	3.98	-	-
Euras		2.71	-1.27	000
Contesa de Paris		2.77	-1.21	000
Williams		3.19	-0.79	00
Curé	*Cydonia oblonga Mill*	3.02	-0.96	00
Euras		2.52	-1.46	000
Comptesse de Paris		3.28	-0.70	0
Williams		1.36	-2.62	000

DL 5% = 0.53 DL 1% = 0.74 DL 0.1% = 1.03 g/100g f.s.

In fig. 2 it has been reported the peroxidases activity above the joining zone, in the joining zone and under the joining zone at studied pear varieties.

A higher intensity of peroxidases activity can be observed in the joining zone and above the joining zone for incompatible varieties (Williams and Comptesse de Paris), suggesting a continuous stress caused by grafting wounds. Moreover, at varieties with poor compatibility the higher intensity of peroxidases activity is associated with lower proteins accumulation and lower grafting success percentage.

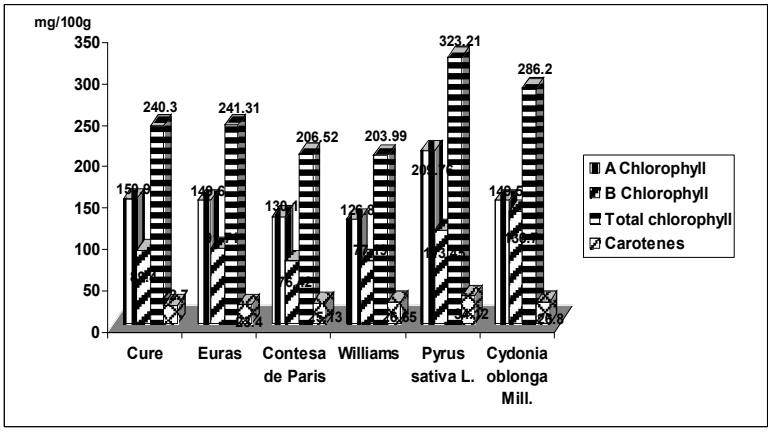

Fig. 3. Varieties and rootstocks content in chlorophyll and carotenes pigments

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.

Chlorophyll A content in varieties leaves is as it follows: the biggest accumulation had Curé (150.90 mg/100 g) and Euras (149.60 mg/100 g) varieties while Comptesse de Paris and Williams had a lower accumulation, of 130.10 mg/100 g and 126.80 mg/100 g. Higher carotenes content had Comptesse de Paris and Williams, with 25.13 mg/100g and respective 26.65 mg/100 g while Curé had only 22.70 mg/100g accumulation and Euras 23.40 mg/100g (7).

CONCLUSIONS

1. By grafting, there was stimulated glucides accumulation above and in the joining zone and in the same time under the joining zone and rootstock the accumulation was decreased.

2. A higher glucides content in the joining zone at incompatible associations explains the existence of some deficiencies in anatomical structure that does not allow a proper assimilates circulation to the roots.

3. Proteins lower content under the joining zone at Williams variety grafted on quince highlight the localized incompatibility phenomenon that appears at grafting on quince.

4. At the associations with poor compatibility (Williams/quince) could be noticed a higher intensity of peroxidases activity and significant lower proteins content comparing with trees that had a normal development. This fact shows a higher level of stress both in joining zone and upper the joining zone caused by grafting.

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