INHERITANCE AND RELATIONSHIP OF IMPORTANT CHARACTERISTICS FOR DETERMINATION OF GRAFT COMPATIBILITY IN APRICOT

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Graft incompatibility

Rootstock-Scion interaction in fruit trees

Incompatibility

Commercial problem
Loss of money and time

Scientific problem
New scions → new rootstocks

Detection of graft incompatibility at early stages of development
Grafting produces different interactions

Factors influencing grafting failure. Incompatibility

ANATOMICAL

BIOCHEMICAL

PHYSIOLOGICAL
Factors influencing grafting failure. Incompatibility

**Physiological and anatomical vascular discontinuities at the union area**

Nutrient uptake

**Cellular communication through plasmodesmata**


Factors influencing grafting failure. Incompatibility

PHENYLPROPANOID PATHWAY

BIOCHEMICAL

CELL WALL MODIFICATION AND CATABOLISM

OXIDATIVE STRESS


760 QTLs (670) and MTLs (90) linked to a total of 110 agronomic traits:

- Tree development
- Pest and disease resistance
- Flowering
- Ripening
- Fruit quality

86 quantitative
24 mendelian

LITTLE IS KNOWN OF THE GENETIC CONTROL OF GRAFT COMPATIBILITY IN PLANTS.
Objectives

Identification and linkage genetic mapping for genomic region(s) involved in the graft (in)-compatibility trait in apricot.

- Development of an apricot progeny segregating for this agronomic trait
- Phenotypic evaluation of the descendants.
- Inheritance of the graft compatibility trait.

Phenotype

Marker assisted selection (MAS)

Genotype
Material and methods

Year 2011

P. Armeniaca L.

‘Moniqui’ (Mo) incompatible  ‘Paviot’ (Pa) compatible

Year 2012
Spring, 2013

Material and methods

Parents (P. cerasifera x P. munsoniana)

F1

‘Moniqui’ (Mo) incompatible × ‘Paviot’ (Pa) compatible

F1 / ‘Marianna 2624’
(P. cerasifera x P. munsoniana)

5 grafts x 80 indiv = 400 grafts evaluated

+ Parents
Year 2014-2015

Screening of graft compatibility on the progeny grafted onto the plum rootstock ‘Marianna 2624’ was based on anatomical symptoms.

Graft union_one year after grafting

Internal characterization:
(A) Compatible graft union.
(B, C) Phenotypic evaluation of graft incompatibility
   a- necrotic line
   b- bark discontinuity
   c- wood discontinuity

(scored between 0= absence and 5= maximum)
Year 2014-2015

Screening of graft compatibility on the progeny grafted onto the plum rootstock ‘Marianna 2624’ was based on cell behaviour.

Microscopic observations:
- Cell arrangement
- Cell shape
- Cell proliferation at the graft interface
- Red cells at the graft interface

(scored between 0= absence and 5= maximum)

Results and discussion

One year: Necrotic line

66.7% → high parental segregation

33.3%

Number of individuals
Results and discussion

One year: Wood and bark discontinuity

Bar graph showing the number of individuals with wood discontinuity and bark discontinuity for Paviot and Moniqui.

- Wood discontinuity:
  - Paviot: 72.83%
  - Moniqui: 43.20%

- Bark discontinuity:
  - Paviot: 9.87%
  - Moniqui: 43.20%

Images of wood and bark discontinuity examples are also shown. 

CITA logo is in the bottom right corner.
### Results and discussion

<table>
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<tr>
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<th>Necrotic line</th>
<th>Wood discontinuity</th>
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<tr>
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One year: Pearson Correlation
Results and discussion

4 principal groups

I $\rightarrow$ 16.04% grouping with Mo
II y III $\rightarrow$ not determined
IV $\rightarrow$ 52.65% grouping with Pa

65 compatible individuals
13 incompatible individuals

Over half of the grafted individuals are grouped together with compatible parental 'Paviot'
One month after grafting

Results and discussion

Moniqui
Paviot

Cell arrangement

Moniqui
Paviot

Cell proliferation at the graft interface

Moniqui
Paviot

Cell shape

Moniqui
Paviot

Red cells at the graft interface

Moniqui
Paviot
### Results and Discussion

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#### Correlation Coefficients

- **Significant at 0.000**

### Compatibility

- **Compatible**
- **Necrotic line**
- **Incompatible**
- **Vascular discontinuity**
Apricot progeny segregating for the graft compatibility trait.

The necrotic line, discontinuities in the bark and wood, and cell/tissue organization are highly correlated.

GRAFT COMPATIBILITY IS A COMPLEX AGRONOMIC TRAIT.
Future perspectives

- Phenotypic evaluation of more F1 individuals of the population. Total: 156 individuals.

- Development of a new genetic linkage map in the apricot progeny ‘Mo * Pa’ segregating for the graft compatibility trait using SSRs and GBS.

- Identification of QTL(s) and candidate genes associated with graft compatibility, responsible for the phenotypic expression.
  - Genome wide SNP identification and QTL mapping for graft compatibility in apricot.
  - eQTL mapping using RNA-seq data.

Knowledge of graft compatibility inheritance in other progenies will help cultivar and rootstock breeding and will contribute to further understand the genetic mechanism of graft compatibility.
Acknowledgements

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THANK YOU VERY MUCH

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