Genetic diversity of almond rootstocks. The INRA Prunus rootstock breeding program

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SOUS L'EGIDE DU MINISTÈRE DE L 'AGRICULTURE ET DE LA PÊCHE MARITIME

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The INRA *Prunus* rootstock breeding program

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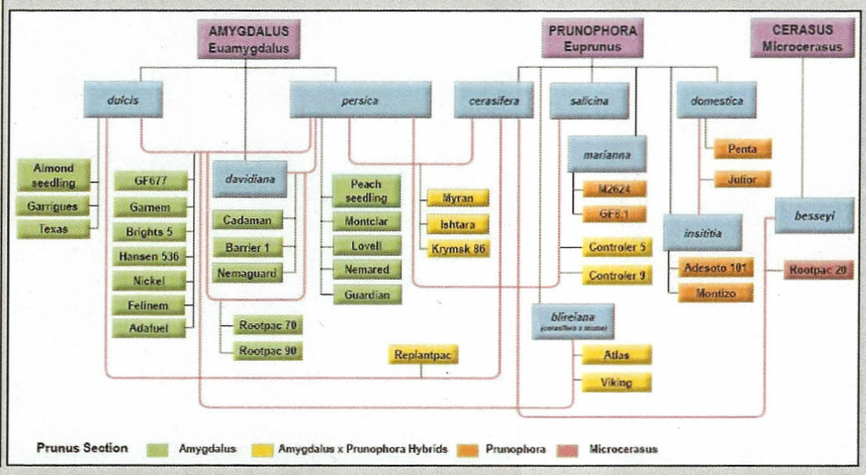
The place of the of almond rootstocks in the Redher *Prunus* classification

- Most of the almond rootstocks belongs to the amygdalus section. All have a good graft-compatibility with almond varieties
- Peach*almond and peach*davidiana Hybrids are well represented.
- Very few rootstocks are issued from intra specific Prunophora species.
- .Crossings between Amygdalus species and Prunophora species gave several original almond rootstocks.
- Microcerasus species like *Prunus besseyi* are interesting genitors to obtain dwarfing rootstocks.



Horticultural characteristics of commercial almond rootstocks.

Rootstock	Vigor	Calcareous Tolerance	Waterlogging tolerance	Drought Tolerance	RKN-Mi.	RKN - Ma	RKN - Mj	Lesion Nematods	Armillaria
Almond seedling	standart	high	poor	high	S	S	S	S	S
Lovell	standart	poor	fair	fair	S	S	S	S	S
Nemared	standart	poor	poor	fair	R	R	MS	S	S
GF677	high	high	fair	high	S	S	S	MR	S
Hansen 536	high	high	fair	good	R	R	MR	MR	S
Brights 5	standart	high	fair	good	R	R	MR	MR	S
Garnem (GN15)	high	high	fair	good	R	R	MS	MR	S
Nemaguard	standart	poor	fair	fair	R	R	MR	S	S
Cadaman®avimag	high	fair	fair	good	R	R	MR	S	MS
Barrier I	standart	fair	fair	good	R	R	MR	S	S
Krymsk 86	semi-dwarf	poor	good		S	S	S	S	S
Rootpac® Replantpac	standart	good	good		MR	MR	MR	S	
Ishtara®Ferciana	semi-dwarf	good	good		R	R	R	MS	MR
Myran®Yumir	semi-dwarf	poor	good		R	R	R		MR
Atlas	standart	fair	poor	fair	R	R	R	S	
Viking	high	fair	fair	fair	R	R	R	S	
Marianna 2624	semi-dwarf	good	good		R	R	R	S	R
Penta	semi-dwarf	good	good		R	R	MR	S	
Julior®	semi-dwarf	fair	good		R	R	R	S	
Rootpac ® 20 Densipac	dwarf	fair	good		R	R	R	R	

Amygdalus section
Amygdalus * Prunophora hybrids
Prunophora section
Microcerasus * Prunophora hybrids

* graft-incompatibility with some varieties (Nonpareil, Ferraduel ...)
* RKN = Root Knot Nematodes - Mi : *Meloidogyne incognita* , Ma : *Meloidogyne arenaria* , Mj : *Meloidogyne javanica*

The INRA *Prunus* Rootstock Breeding program

The main objectives of the INRA breeding program is to obtain:

- **High resistance to RKN Nematodes** by pyramiding three resistance genes : *RMja* from Alnem almond, *RMia* from Nemared peach, *Ma* from P2175 myrobalan
- **Good tolerance to waterlogging, calcareous soils and armillaria disease.**

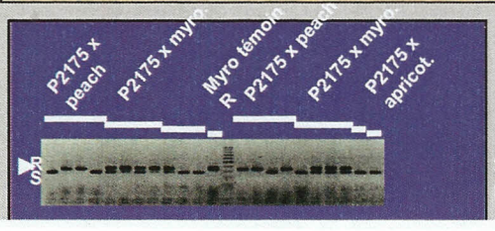
The strategy is the following:

Materiel: Several crosses two or three ways: peach * almond * myrobalan
Method: To develop molecular markers for MAS (Marker Assisted Selection)
First results:

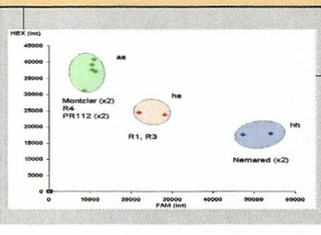
- Identification of intra-gene markers for the two nematodes resistance genes *Ma* and *RMia* (Claverie M and *al*, 2011, *Plant Physiology);* (Duval H and *al*, 2014*; TGG)*
- 13 preselected rootstock hybrids with the two genes *Ma* and *RMia.*

Next results:

- Mapping of a population "Lauranne x Alnem"
- Identification of new molecular markers for the *RMja* resistance gene of Alnem.
- Preselecting of Alnem* (peach * myrobalan) hybrids pyramided with the three resistance genes.



SAM for the *RMia* gene with the KASP™ marker SNP_APP92



SAM for the *Ma* gene with the marker NSCAFLP2