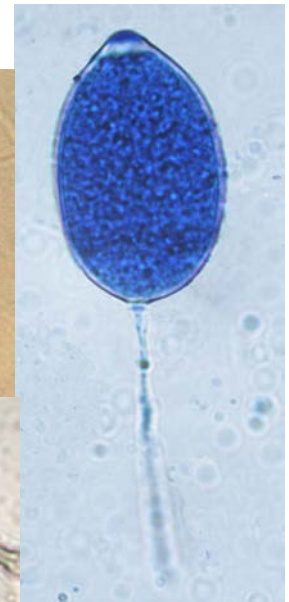
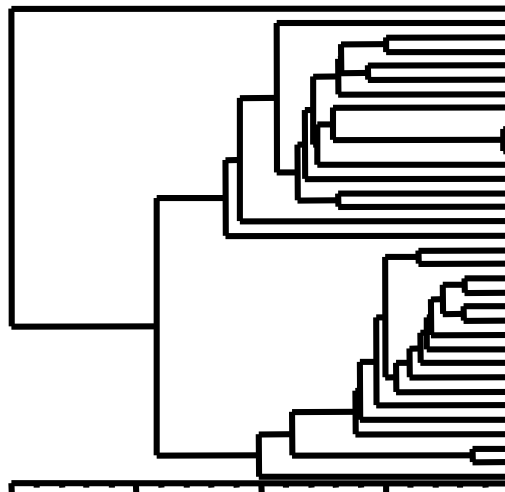
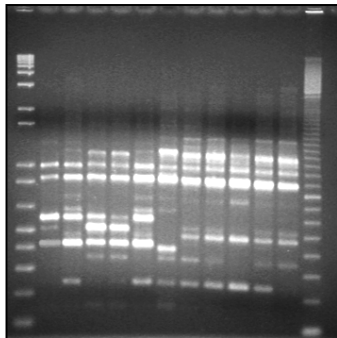
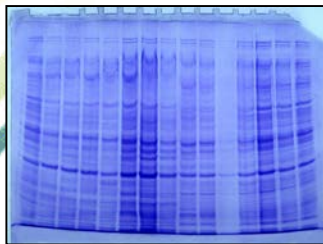


# PAV – collection of plant pathogen microorganisms: fungi, oomycetes, bacteria, viruses, and viroids

Council for Agricultural Research and Economics - Plant  
Pathology Research Center of Rome, Italy

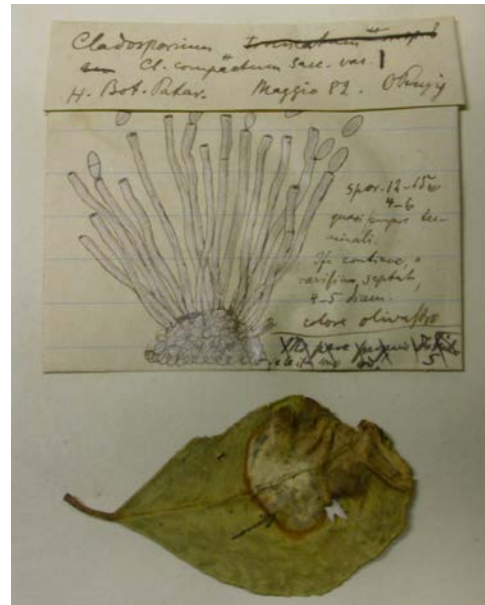


Before talking about the PAV-collection of living microorganisms just few words on the historical scientific roots of our Institute which harbors several Herbaria: The most famous is: the Herbarium of fungi of citrus of Otto Penzig a famous German mycologist

*Herbarium Mycologicum Romanicum*  
*Mycotheca Italica* (of Saccardo)

Herbarium Crittogamico Italiano (of Anzi, Arcangeli, Carestia, Passerini, Spegazzini)

Herbarium of parasitic fungi of cultivated plants (of Cavara, Briosi, Pollacci).



**The PAV-collection of phytopathogenic microorganisms includes fungi, oomycetes, bacteria, viruses and viroids**

**It is a working collection and the microorganisms or infective entities here preserved derived from research or diagnostic activities**

**A group of core isolates have been included in a national collection project named COLMIA**

**Consultable on the web at:**

**[www.colmia.it](http://www.colmia.it)**

This National project included 11 working units each with its *in-situ* collection of microorganisms associated with agricultural research fields (soil, diseases, entomopathogenic activity) or transformation processes (wine, cheese, table-olives)



The screenshot shows the COLMIA website interface. At the top, there is a logo for COLMIA and navigation links for "About COLMIA", "Research Institutions", and "Culture Collection Handbook". Below the logo, there is a search bar labeled "Filtro ricerca" with buttons for "Azzerare parametri" and "Cerca". On the left side, there is a list of microorganism types: "Plant Pathogenic Viruses and Viroids", "Plant Pathogenic and Entomopathogenic Bacteria", "Plant Pathogenic, Entomopathogenic and Soil Fungi, and Oomycetes", "Soil Bacteria", "Table Olive processing Bacteria", and "Dairy Bacteria". The main content area is titled "Benvenuto" and contains a welcome message in Italian, followed by a list of information provided for each microorganism, such as "Nome del genere, specie, autore e numero di accesso", "Substrati di crescita e metodo di conservazione", "Area di origine, anno di isolamento e nome del depositario", "Numero di accesso ad altre collezioni", "Dati biologici, chimici e fisiologici", and "Riferimenti a pubblicazioni in cui i singoli isolati sono citati".

Specimens listed in COLMIA are just few among hundreds of single-cell strains conserved in PAV

Most of them are characterized and subjected to phylogenetic and molecular studies

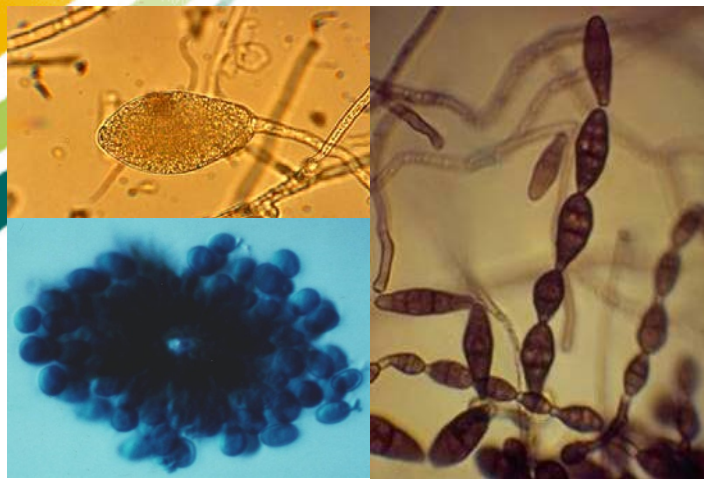


Table 1. List of main species or genera of the plant pathogen microorganisms or infective entities included in COLMIA ([www.COLMIA.it](http://www.COLMIA.it))

Microorganism or entity	N. of strains
<b>Fungi</b>	<b>251</b>
<i>Alternaria</i> spp.	7
<i>Ascochyta rabiei</i>	19
<i>Bipolaris</i> spp. (Of which 14 <i>Bipolaris oryzae</i> )	16
<i>Drechslera teres</i>	12
<i>Drechslera graminea</i>	23
<i>Fusarium</i> spp.	51
<i>Fusarium lateritium</i>	54
<i>Marssonina juglandis</i>	5
<i>Monilia</i> spp.	13
<b><i>Monilia fructicola</i> quarantine organism</b>	<b>6</b>
<i>Neotyphodium</i> spp.	14
<i>Phomopsis</i>	4
<i>Pyrenochaeta lycopersici</i>	22
<i>Tubakia dryina</i>	5
<b>Oomycetes</b>	<b>11</b>
<i>Phytophthora cactorum</i>	1
<i>Phytophthora cinnamomi</i>	4
<i>Phytophthora hedraiaandra</i>	2
<i>Phytophthora megasperma</i>	1
<i>Phytophthora niederhauserii</i>	3
<b>Bacteria</b>	<b>62</b>
<i>Brenneria nigrifluens</i>	4
<i>Erwinia carotovora</i>	5
<i>Pseudomonas avellanae</i>	10
<i>Pseudomonas syringae</i>	11
<i>Xanthomonas arboricola</i>	16
<i>Xanthomonas campestris</i>	6
<b>Virus and viroids</b>	<b>35</b>
Apple scar skin viroid	1
Hop stunt viroid	2
Peach latent mosaic viroid	3
Pear blister canker viroid	1
Beet pseudo yellow virus	1
Caper latent virus	2
Cucumber mosaic virus	1
Cucurbit aphid-borne yellows virus	2
<b><i>Plum pox virus</i> quarantine organism</b>	<b>23</b>

**In our Institute are  
stored approximately:**

**2500 Fungi**

**130 Phytophthoras**

**860 Bacteria**

**300 Virus & viroids**




One of the purpose of a collection is to **preserve biodiversity**. In PAV-collection are maintained isolates of the same pathogenic species for **preserving the variability** within the population in terms of virulence, metabolite/toxin production, pesticide resistance, etc.


We have numerous **strains that are used as reference in pathogenic tests**


I will be giving some examples about fungi, bacteria, and viruses showing the information provided on the web site catalogue of COLMIA

## COLMIA


### Select Microorganism Type

 Plant Pathogenic Viruses and Viroids

 Plant Pathogenic and Entomopathogenic Bacteria

 Plant Pathogenic, Entomopathogenic and Soil Fungi, and Oomycetes

 Soil Bacteria

 Table Olive processing Bacteria

 Dairy Bacteria

 Wine Bacteria

### Fusarium lateritium ISPaVe 1876

CRA-PAV3018

#### Generality

Anamorph	Fusarium lateritium Nees:Fr
Isolated by	A. Belisario
Identified by	A. Santori
Teleomorph	Gibberella baccata (Wallr.) Sacc.
State	Italy
Accession Number	ISPaVe MCF 1876
Region (regione)	Lazio
Host	Corylus avellana; Hazelnut
Place of maintenance	Centro di Ricerca per la Patologia Vegetale

#### Maintenance Method

Maintenance Method	Subculturing	<input type="checkbox"/>
	Filter paper	<input type="checkbox"/>
	Mineral oil	<input type="checkbox"/>
Growing medium	PDA	
Year	2011	
N° of replicate maintained	4	


#### Characterization


Molecular and/or biochemical characterization	ITS; Beta tubulin; TEF 1-alpha
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#### Supply

Supply	Active
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## Select Microorganism Type

 Plant Pathogenic Viruses and Viroids

 Plant Pathogenic and Entomopathogenic Bacteria

 Plant Pathogenic, Entomopathogenic and Soil Fungi, and Oomycetes

 Soil Bacteria

 Table Olive processing Bacteria

 Dairy Bacteria

 Wine Bacteria

 Wine Yeasts

## Monilia fructicola ER 1796

CRA-PAV3313

### Generality

Anamorph	Monilia fructicola
Isolated by	Luca Riccioni
Identified by	Luca Riccioni
Year	2012
State	Italy
Accession Number	ER 1796
Region (regione)	Lazio
District (provincia)	Latina
Host	Prunus domestica; Plum
Host variety	Angeleno
Place of maintenance	Centro di Ricerca per la Patologia Vegetale
Isolated from	fruit

### Maintenance Method

Maintenance Method	Mineral oil
Growing medium	PDA
Year	2012
N° of replicate maintained	2

### Others

Information on the strain	EPPO A2 List
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### Characterization

Molecular and/or biochemical characterization	PCR (M. J. Côté et al. (2004). Plant Dis 4: 1219-1225; R. Ios and P. Frey (2000). Eur. J. Plant Pathol. 106: 373-378).
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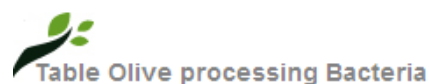
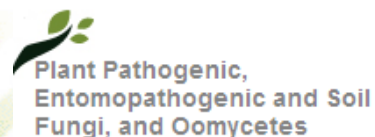
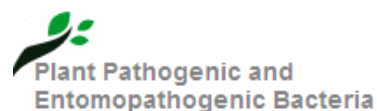
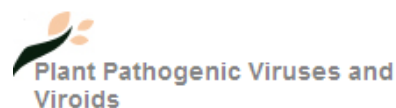
### Supply

Supply	Active
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COLMIA: Collezione di microorganismi di interesse agrario, industriale e ambientale, con il patrocinio del Ministero delle Politiche Agricole Alimentari e Forestali (MiPAAF)



### Select Microorganism Type



Supply

## Xanthomonas arboricola pv. juglandis MCB 1134

CRA-PAV1087

### Generality

Species	Xanthomonas arboricola
Isolated by	A. Gallelli
Synonym Species	Xanthomonas campestris
Identified by	S. Loreti
Accession Number	ISPaVe MCB 1134
Year	1999
Other subspecific rank	pv. juglandis
State	France
Host	Juglans regia L., Walnut
Region (regione)	---
Isolated from	Fruit
Location	Ile
Place of maintenance	Centro di Ricerca per la Patologia Vegetale

### Maintenance Method

Maintenance Method	lyophilization
Growing method/medium	YDC,NAG
Year	---
N° of replicate maintained	2


### References

References	Loreti S., Gallelli A., Belisario A., Wajnberg E., Corazza L. 2001. Investigation of genomic variability of Xanthomonas arboricola pv. juglandis by AFLP analysis. European Journal of Plant Pathology 107: 583-591.
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### Characterization

Molecular characterization	SDS-PAGE of whole cell protein extracts; AFLP
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## Select Microorganism Type



Plant Pathogenic Viruses and Viroids



Plant Pathogenic and Entomopathogenic Bacteria



Plant Pathogenic, Entomopathogenic and Soil Fungi, and Oomycetes



Soil Bacteria




Table Olive processing Bacteria



Dairy Bacteria



Wine Bacteria

## Plum pox virus PPV ISPaVe 44

CRA-PAV2636

### Generality

Specie	Plum pox virus
Acronym	PPV
Genus	Potyvirus
Family	Potyviridae
State	Italy
Strain	M
Region (regione)	Veneto
Accession Number	PPV ISPaVe 44
Isolated from	peach ( <i>Prunus persica</i> )
Host variety	Royal Glory
Place of maintenance	Centro di Ricerca per la Patologia Vegetale

### Maintenance Method

Maintenance Method	1	Lyophilized (**)
	2	On woody indicator (***)
N° of replicate maintained	(**)=1; (***)=1	

### Characterization

Serological characterization	TAS-ELISA (kit Agritest)
Molecular and/or biochemical characterization	RT-PCR

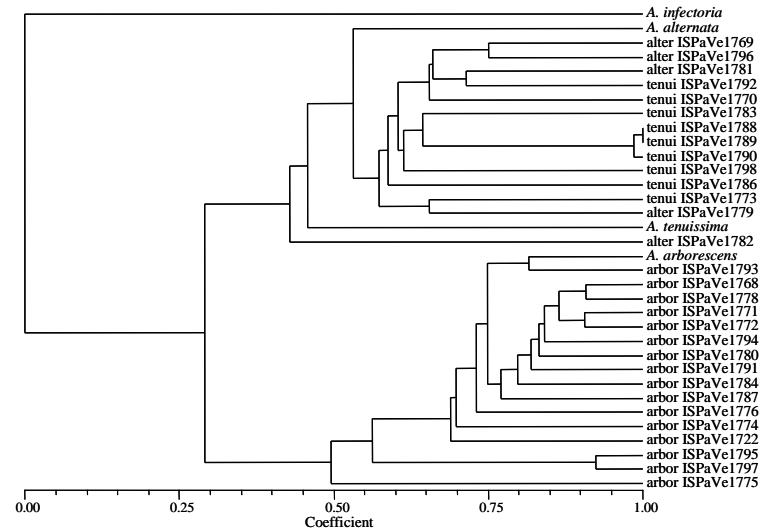
### Supply

Supply	Fresh material
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*Alternaria alternata* complex or “small-spored catenulate *A. alternata* species groups pathogenic on nuts (walnut & hazelnut)



AFLP, ISSR, H4 polyphasic classification



*A. alternata* complex strains

*A. alternata*

*A. tenuissima*

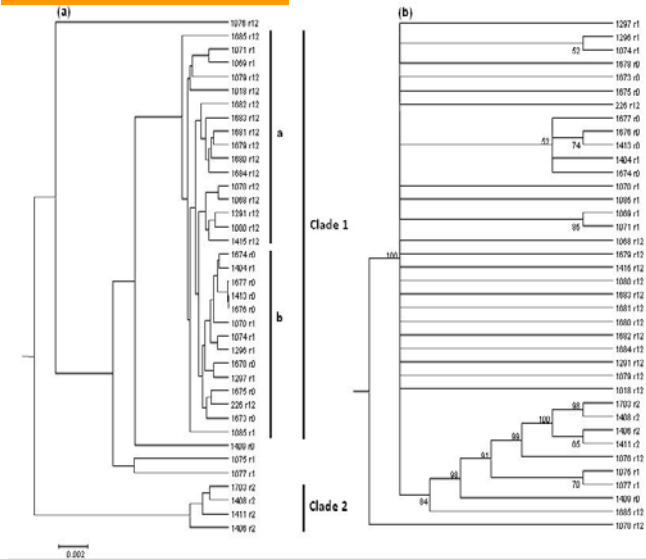
*A. arborescens*



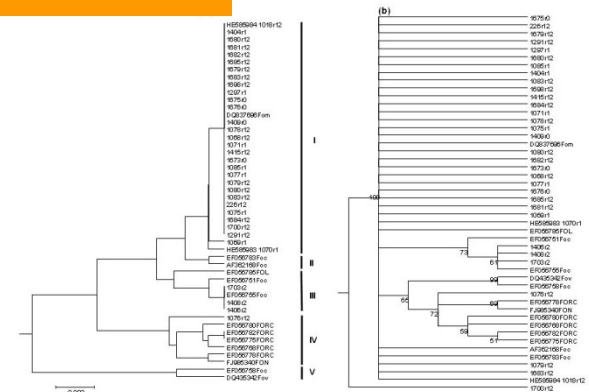
Forty (40) strains of *Fusarium oxysporum* f. sp. *melonis* (FOM) characterized by race, RAPD profile and phylogeny to distinguish the 4 races by UPGMA with the Neighbor-joining analysis



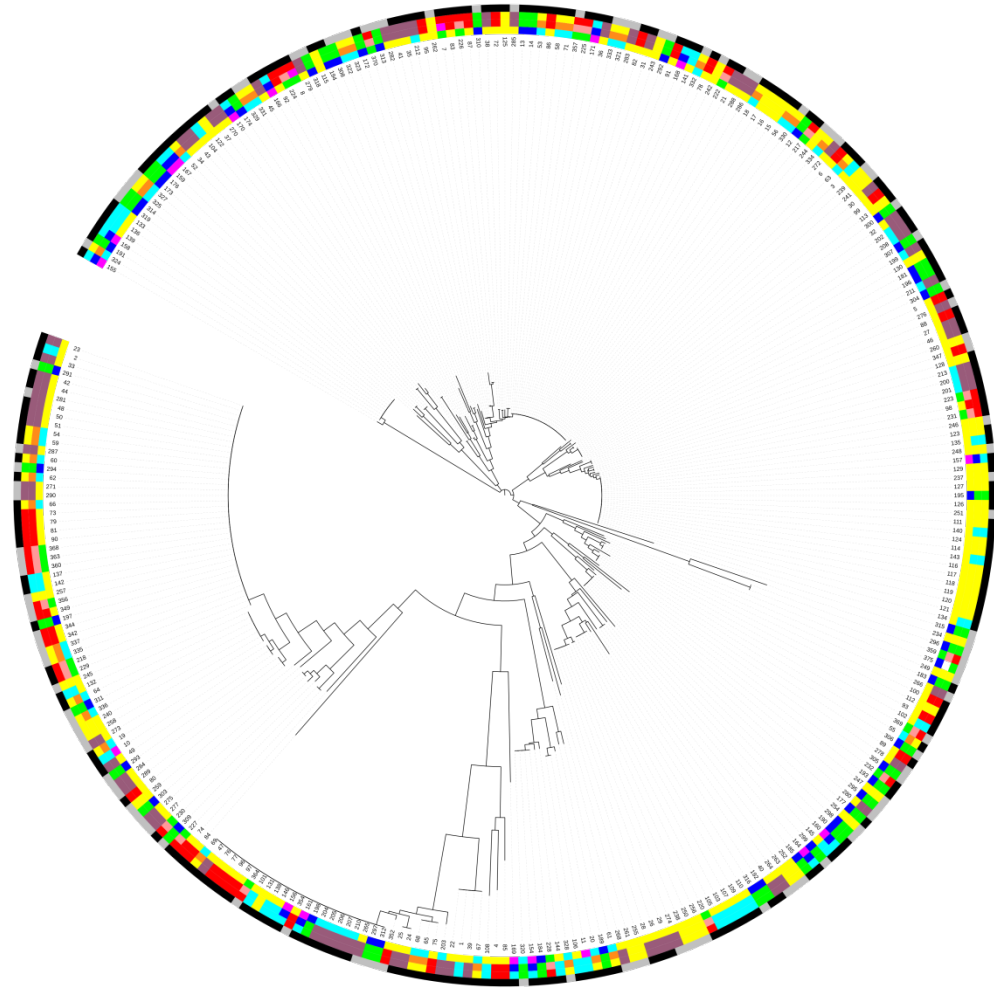
### RAPD



### TEF-1α



## Neighbor-joining analysis of Simple Sequence Repeats (SSR) of 315 Italian *Fusarium fujikuroi* isolates





## AFLP analysis of *Xanthomonas arboricola* pv. *juglandis* pathogenic on walnut (104 strains in PAV-collection)

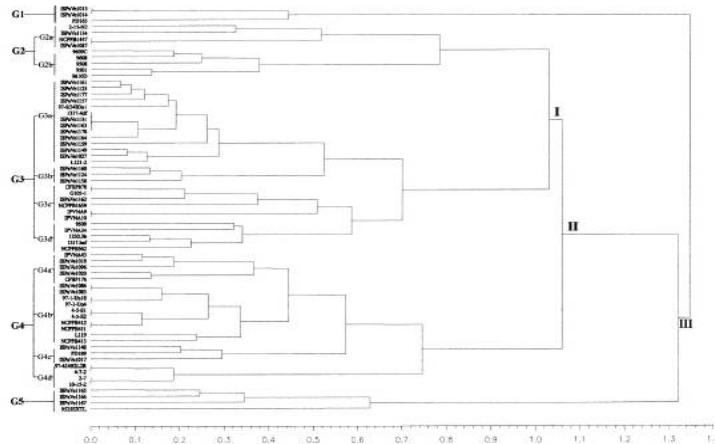
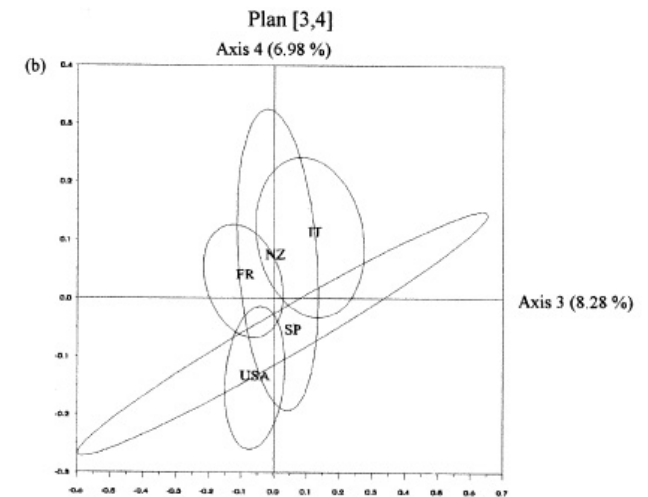
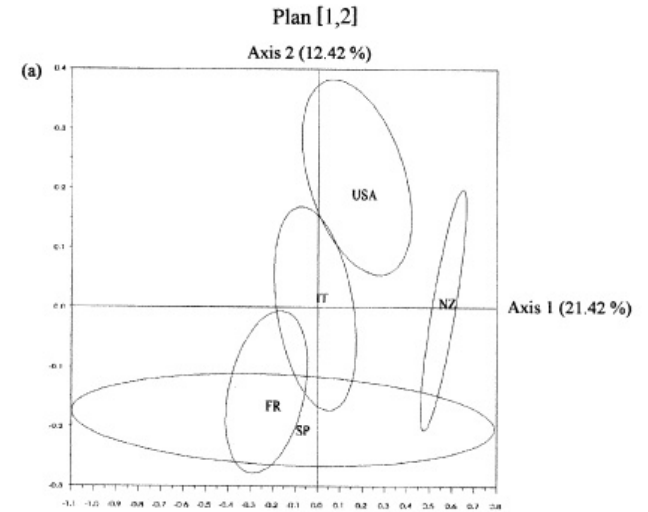
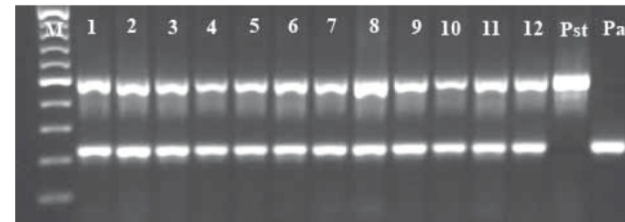
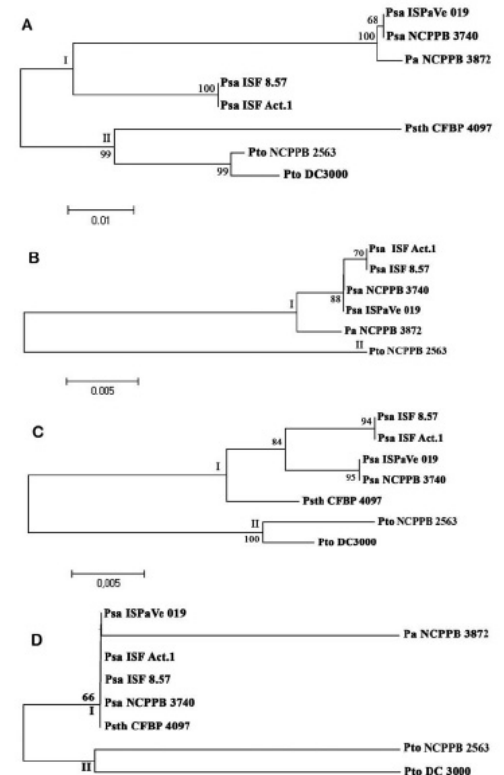


Figure 2. Dendrogram constructed from the coordinates of the 66 isolates of *X. arboricola* pv. *juglandis* studied on the first five axes of a multiple correspondence analysis. The dendrogram shows the distances between isolates according to AFLP profiles. Groups G1 to G5 were delimited at a distance of 0.78 and are shown with the respective subgroups that are detailed in Table 2. Groups were organized in clusters (I, II, III).



## Gene-sequence analysis of genes involved in plant - pathogen interaction for developing a diagnostic method of *Pseudomonas syringae* pv. *actinidiae* (241 strains in PAV-collection)





More than 300 isolates of 70 viruses, viroids and phytoplasmas are collected in our Institute since the 90's

These species are pathogens of the major agricultural crops: vegetables, fruit trees, grapevine



# Viral pathogens of particular interest

**Plum Pox Virus:** M, D, EA, Rec, C strains



**Peach Latent Mosaic Viroid:** severe, mild and calico isolates



**Flavescence Dorée:** C and D isolates



**Potato Spindle Tuber Viroid:** tomato, *Solanum jasminoides*, *Cestrum* spp. isolates



**Potato Virus Y:** O, N, NTN, W strains



Strains are preserved following several methods suitable to the type of organism

For fungi:

**Tubes with agarized medium (slants)**

**Mineral oil**

**Water**

**Liquid nitrogen**

**Filter paper**

For bacteria:

**Maintenance at  $-80^{\circ}\text{C}$  in glycerol**

**Freeze-drying**

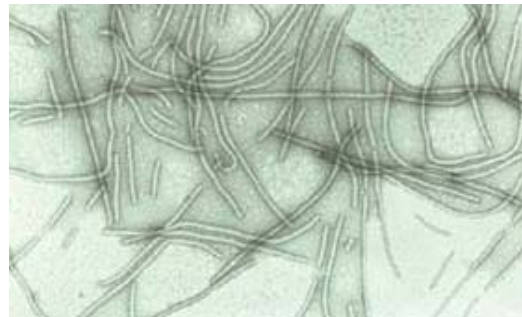
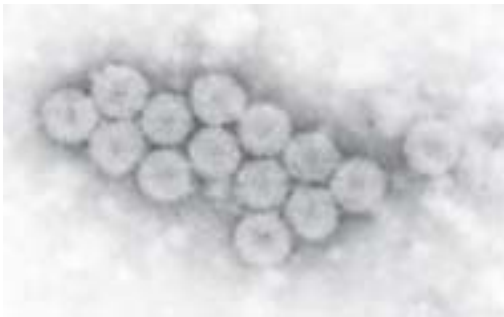


For phytoplasmas:

**DNA extract maintained at -80°C**  
**Plant tissue freeze-drying**

For viruses and viroids:

**RNA/DNA extract maintained at -80°C**  
**Plant tissue freeze-drying**  
**Preservation on plants**



## About the future



**To develop a PAV-collection catalogue on the web**

**To reach a continuity in maintenance and implementation of the collection**

**To have a curator fully dedicated to PAV-collection**

**Last but not least to have stable funding to support all the activities**

Thank you for  
your  
attention!!