

# Research on CpGv resistance in France Luzern 23-24/10/2006



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Arysta LifeScience

# Carpovirusine around the world

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Active ingredient : Codling moth Granulovirus, Mexican isolate (CpGV-M)

Rate of application :  $10^{13}$  CpGv granules per hectare every 10-12 days

Carpovirusine is registered in 13 countries around the world.

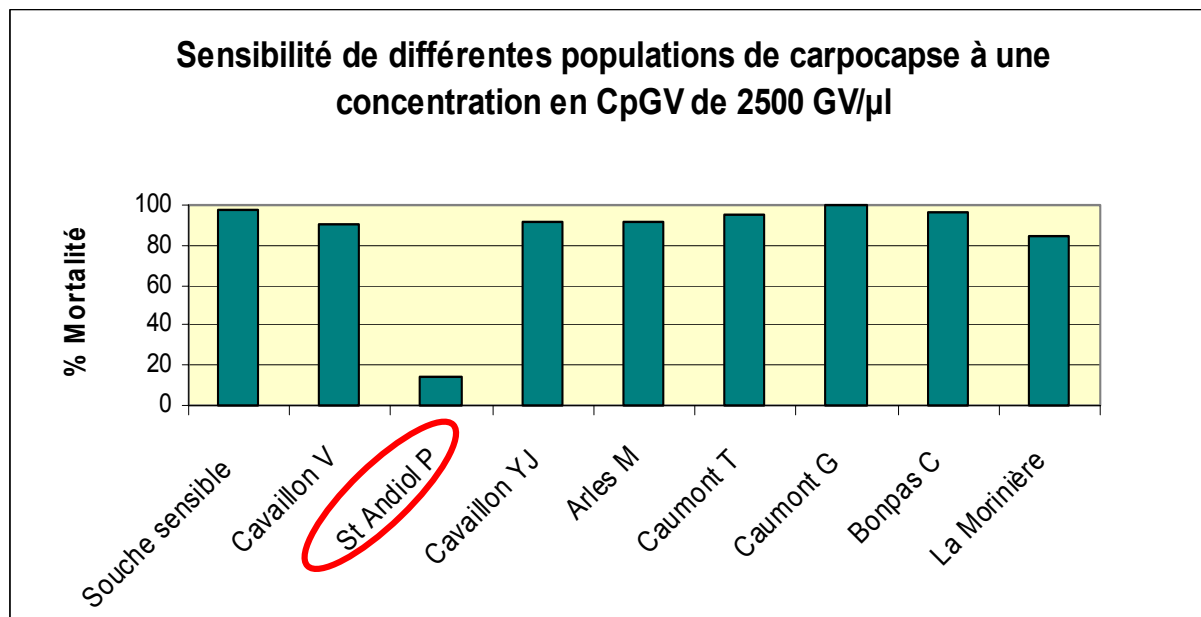
It has been used for 10 years by organic and conventional apple and pear growers, as a very efficient tool for Codling moth control.

Carpovirusine and other CpGV-based products are considered as the best alternative to resistance to chemicals ; Carpovirusine can be efficiently associated with mating disruption

Since 2004, symptoms of lowered susceptibility to CpGV were detected in several places in Europe



***Codling moth populations collected from field in 2004 (South East of France) and artificially reared in the lab in 2005 and inoculated with a discriminant dose (LD95: 2500GV/ $\mu$ l) in a surface diet bioassay***

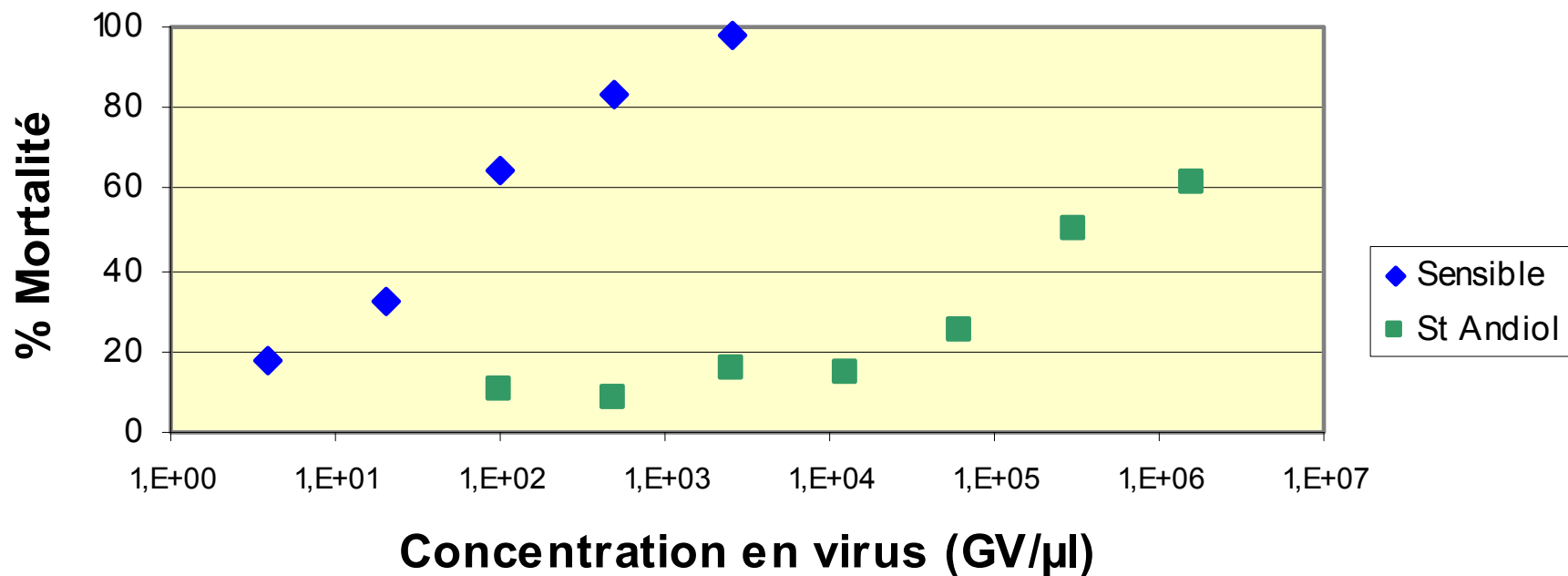


**Only 1 population is significantly different from the lab reference; It is the only population from an organic orchard.**



# Susceptibility comparison between resistant strain (St Andiol) and susceptible reference

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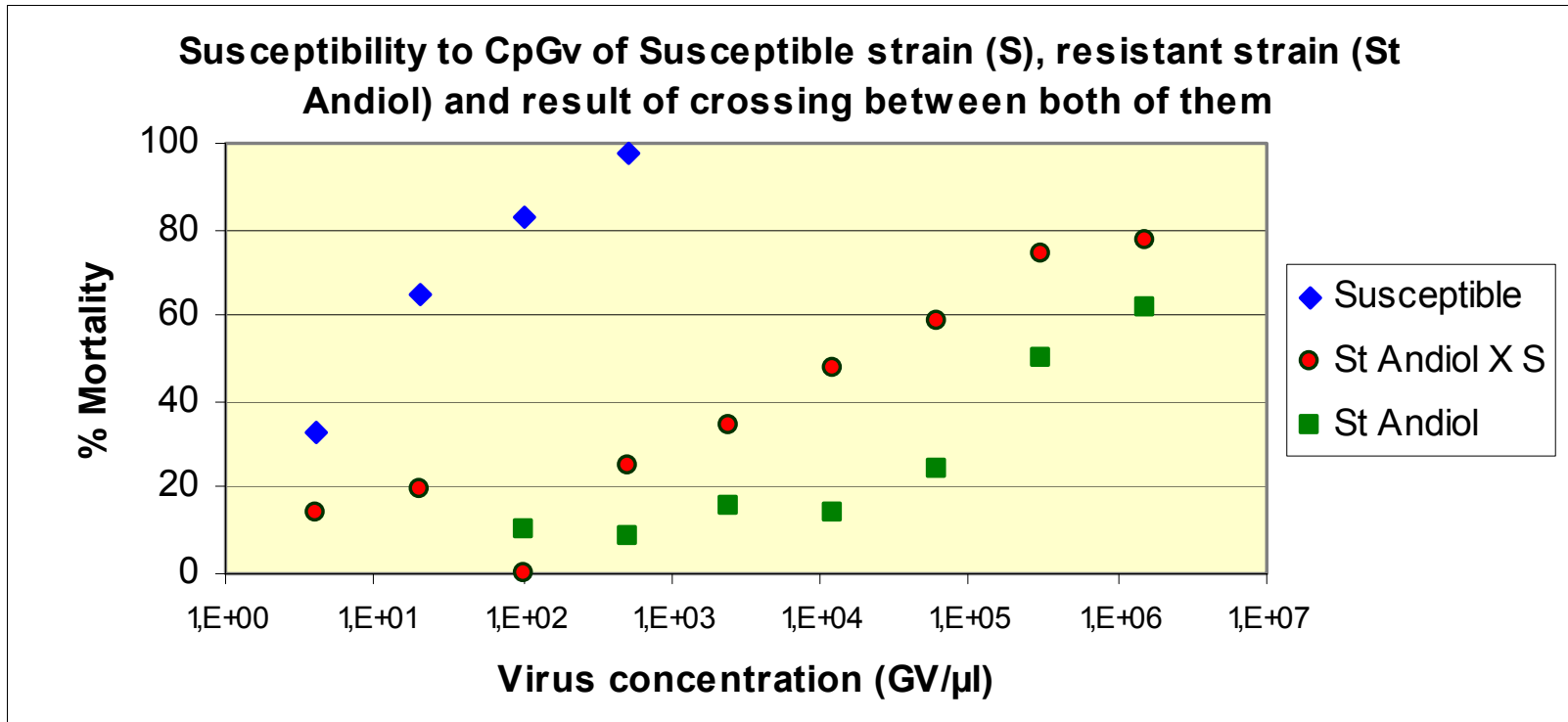
CL50 Susceptible strain : **47.2 GV/μl** [35.6 - 61.1]

CL50 St Andiol : **6,083.10<sup>5</sup> GV/μl** [2.765.10<sup>5</sup> – 1.938.10<sup>6</sup>]



**Ratio of susceptibility: 1:13 000**





Resistance appears to be dominant



# Populations collected in 2005 are screened for resistance detection

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Trap cardboards are collected in orchards where a lowered efficacy has been detected

#	Name	Location	History	Phenotype
1	St Aubin	37	10 yrs organic	R
2	Portes les Valence	26	8 yrs organic	R and S
3	St Andiol	84	10 yrs organic	R
4	Cheval Blanc	84	10 yrs organic	R
5	Loriol	26	10 yrs organic	R
6	Molléges	13	15 yrs organic	R
7	Cavaillon	84	chemical	S
8	Senura	38	mating disruption	S
9	Génolier	Switzerland	no treatment	S
10	Gotheron Eco	26	no treatment	S

## Results (2006)

- Resistance has only been observed in **organic** orchards with a long CpGv history (at least 10 years of intensive application)
- Existence of population with both S and R phenotypes
- 1 resistant population to chemicals shows susceptibility to CpGv

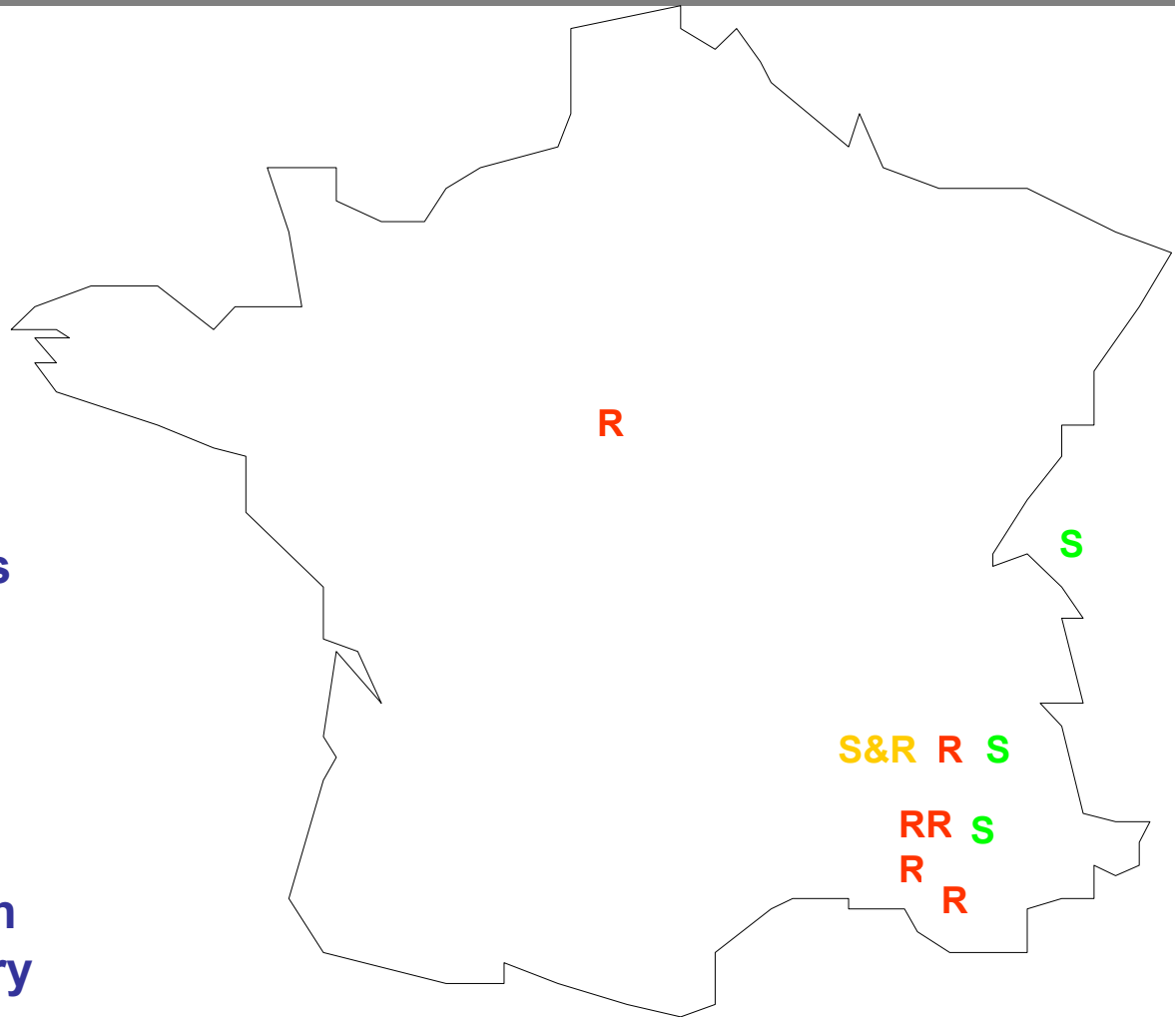


# Spatial distribution of sampled populations

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Populations were sampled in places with problematic lack of efficacy only, referring to technical institutes observations

Resistant phenotypes were found in organic orchards only, with a long CpGv history mainly in the Southeast of France





# State of the knowledge and consequences

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- 1 Resistance is only in organic orchards so far
  - 2 It is dominant, polygenic, and very severe (x13000 times lowered susceptibility)
  - 3 It may differ from the other places in Europe
- Fitness of the resistant populations has to be studied carefully, to evaluate their spreading capacity
  - Technical recommendations will be amended
  - Alternative CpGV strains will be collected from the field or adapted in the lab (parallel coevolution) to overcome the resistance



# Arysta LifeScience's official position regarding the resistance issue

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Arysta LifeScience wants to deliver a clear and responsible message to growers, in order to sustain the use of Carpovirusine in Europe and avoid suspicion towards CpGv.

Our technical recommendations are :

- Always apply Carpovirusine at label rate and spraying interval.
- In case of resistance (some organic orchards, so far), it is useless to increase dose or to spray Carpovirusine more often; other solutions than CpGv are recommended (today organic growers have no alternative to CpGv)
- In most orchards where Carpovirusine is still highly efficient, *do not spray all Codling moth generations with CpGv, in order to break the amplification process in the population.*
- Adopt strong prophylaxis methods (corrugated cardboards, removal of damaged fruits from the orchard after thinning)



# Arysta's involvement in research programs

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- Arysta participate in CRAFT project "Sustain CpGV" with European scientists and other CpGV manufacturers
- Carpores research program: Arysta has been granted subsidies from the French National Agency of Research (ANR) for developing new CpGV isolates with INRA, ARMINES and GRAB
- Arysta LifeScience is willing to carry out field trials with at least one new CpGV isolate in 2007



Arysta LifeScience

- Adaptation of a resistant Codling moth population to the lab, by introgressive back-crossings. This tool will both help studying the fitness of resistant phenotypes and developing new CpGv isolates
- Field collection of biological material
- **CpGv selection on a restrictive host (coevolution)**
- Cloning and validation of the optimal CpGv genotypes
- Field validation and acceptability by growers

