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# Efficacy of CpGV on Oriental Fruit Moth (*Cydia molesta*): myth or reality?

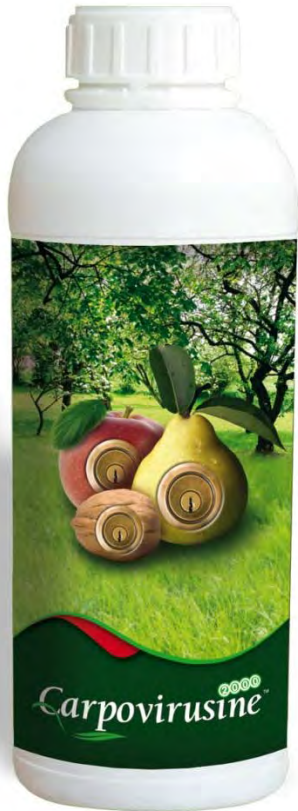
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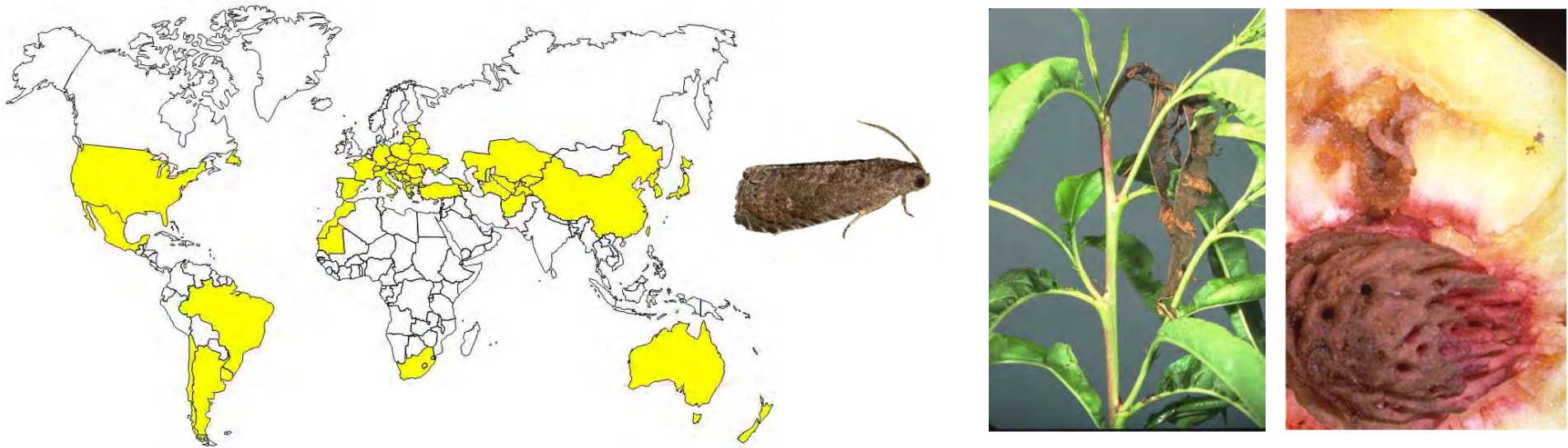
# Carpovirusine



- Virus based insecticide against *Cydia pomonella*
- 'Mexican isolate' CpGV-M described by Tanada in 1964
- Considered as highly selective to Codling moth
- $10^{13}$  CpGV per hectare
- Sold in West Europe since >15 years
- Now registered in >20 countries



# Oriental Fruit Moth (OFM)



- *Cydia molesta* (ex-*Grapholita molesta*), tortrix originated from North-west of China, with worldwide distribution like Codling moth
  - Main host plants are peach and nectarine trees (3-5 generations per year), secondary host plants: other top fruits and ornamentals
  - Early damages on shoots, late damages on fruits
  - Has become important pest on apples and pears in France, Italy, Argentina → big threat for CpGV business
    - Overlapping of generations
    - Similar damages
- Considering closeness with Codling moth (*Cydia pomonella*) in taxonomy, is there a chance of controlling OFM with CpGV?

# Scientific background – CpGV on OFM

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- First publication of OFM susceptibility to CpGV by Falcon, 1969
- Greg Krawczyk (Pennstate University, USA) compared OFM and Codling moth susceptibilities to CpGV in a diet surface bioassay (personal communication, 2004)

Population	n	Slope ( $\pm$ SE)	LC <sub>50</sub> (95% CL)*	LC <sub>90</sub> (95% CL)*
OFM	200	3.44 $\pm$ 0.8	<b>0.042</b> (0.026-0.053)	<b>0.099</b> (0.08-0.145)
CM	350	2.69 $\pm$ 0.3	<b>0.079</b> (0.043-0.114)	<b>0.237</b> (0.157-0.633)

\* The LC<sub>50</sub> and LC<sub>90</sub> are expressed as the rate of formulated product per acre in 100 gallons of water

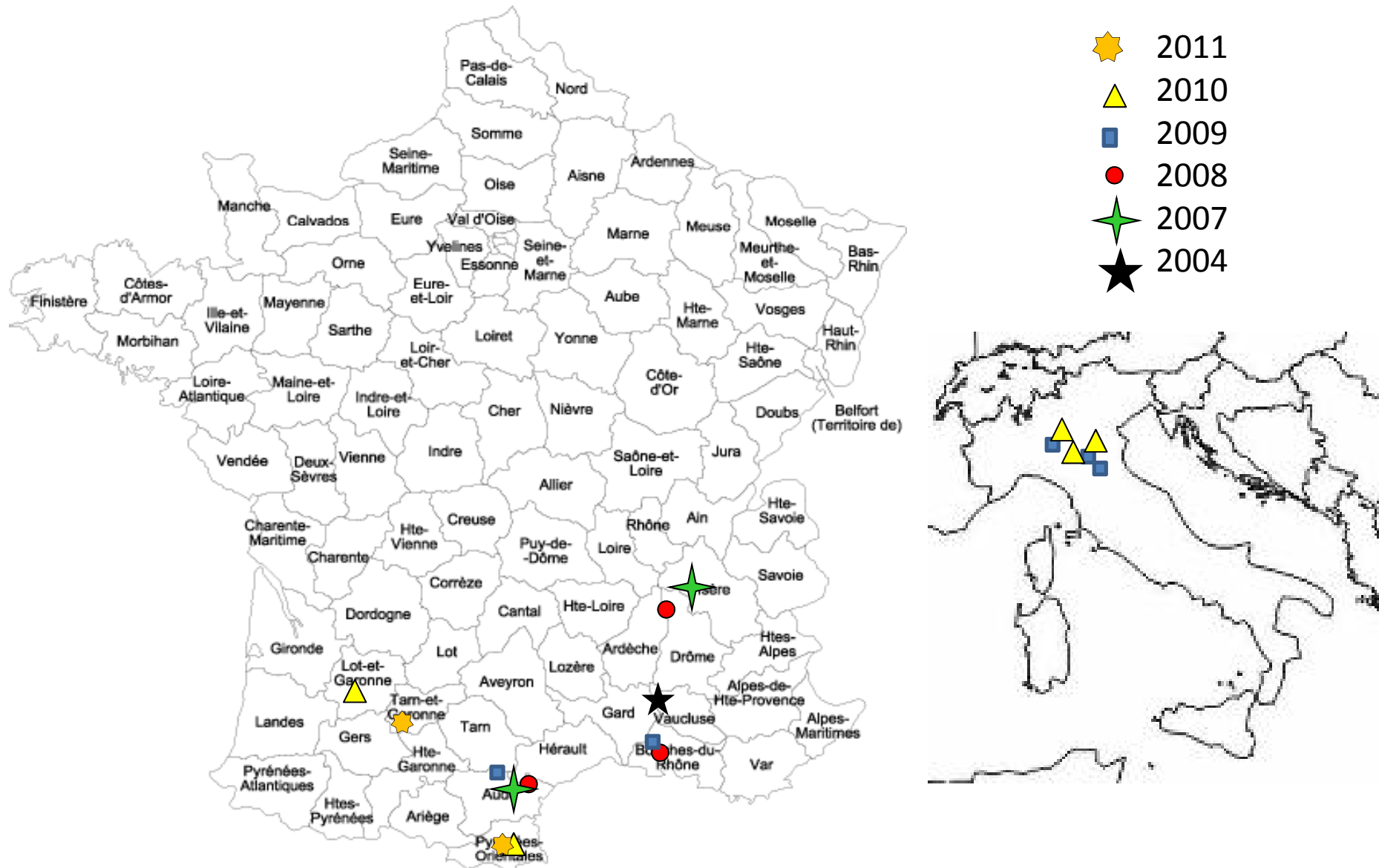
→ *evaluation trial was set up in France by Arysta during summer 2005*

- Greg's results on OFM were confirmed in 2005 (diet surface & apple fruit dip bioassays (unpublished memorandum, 2005)
- Lerry Lacey (Washington State University, USA) established susceptibility ratios of OFM/Codling moth in lab bioassays at respectively 1:557 and 1:559 for LC<sub>50</sub> and LC<sub>90</sub> (Lacey and Headrick, 2005)
- "Label rates of CpGV used for Codling moth control could potentially reduce OFM populations if significant feeding of early instars occurred" (Lacey et al., 2008)

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# Field work made by Arysta

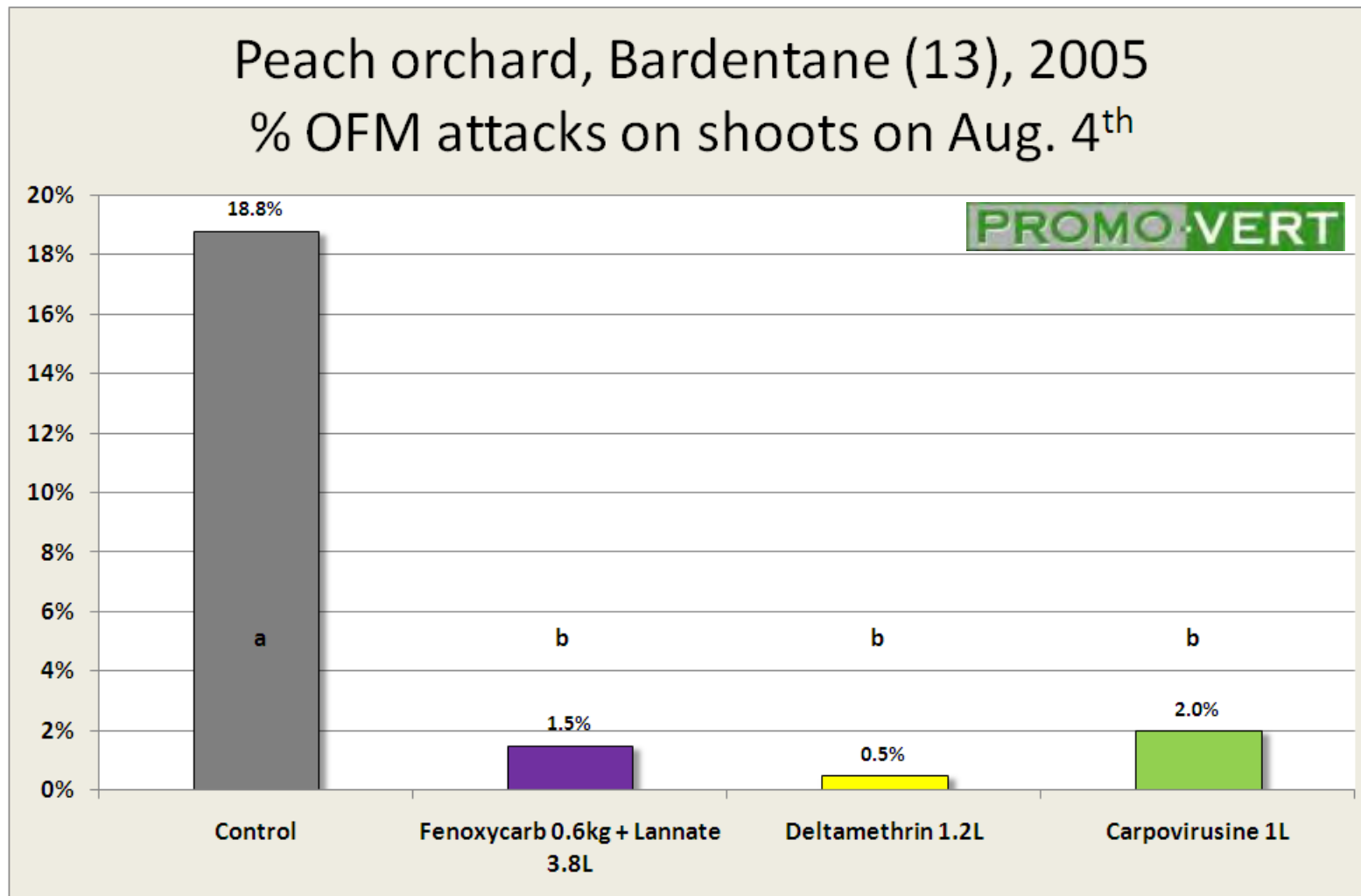
# 18 trials in South Europe zone



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# Evaluation trial on peach

# Evaluation trial, peach, France, 2005



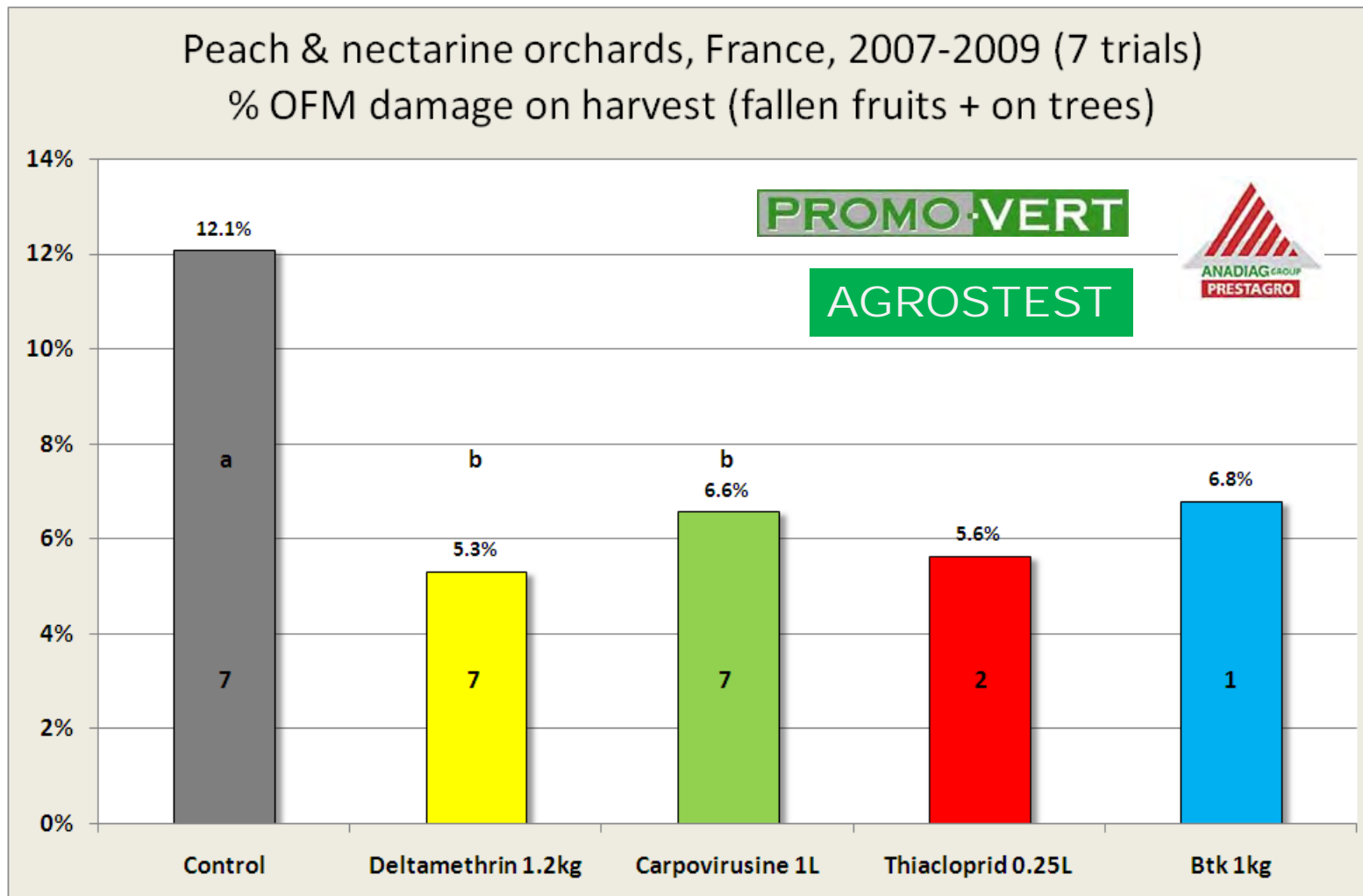
- Positioning on second generation
- Carpovirusine efficacy 89% does confirm Greg Krawczyk 2004 lab experiment



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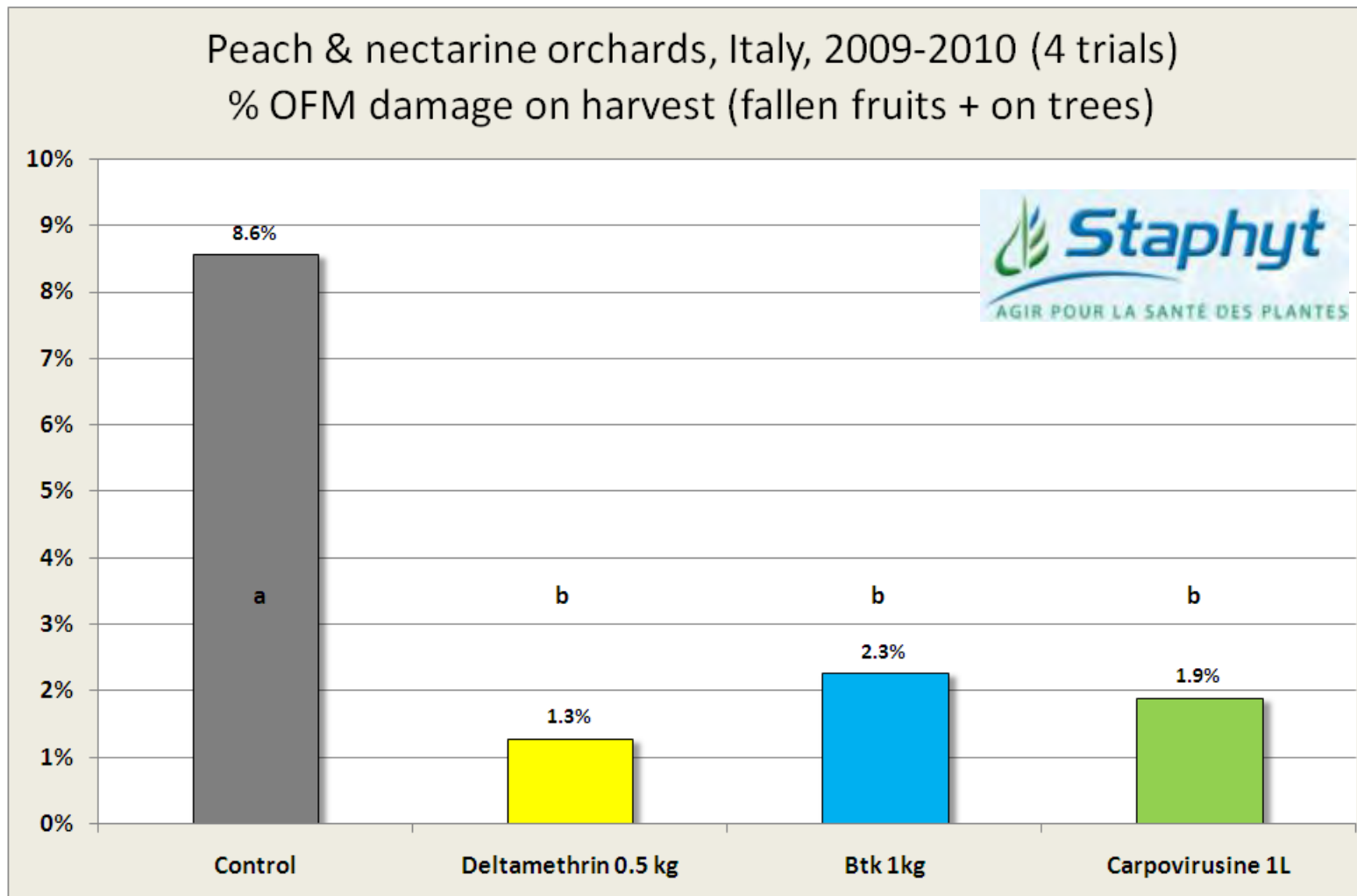
# Development trials on peach / nectarine

# Development trials France, peach/nectarine



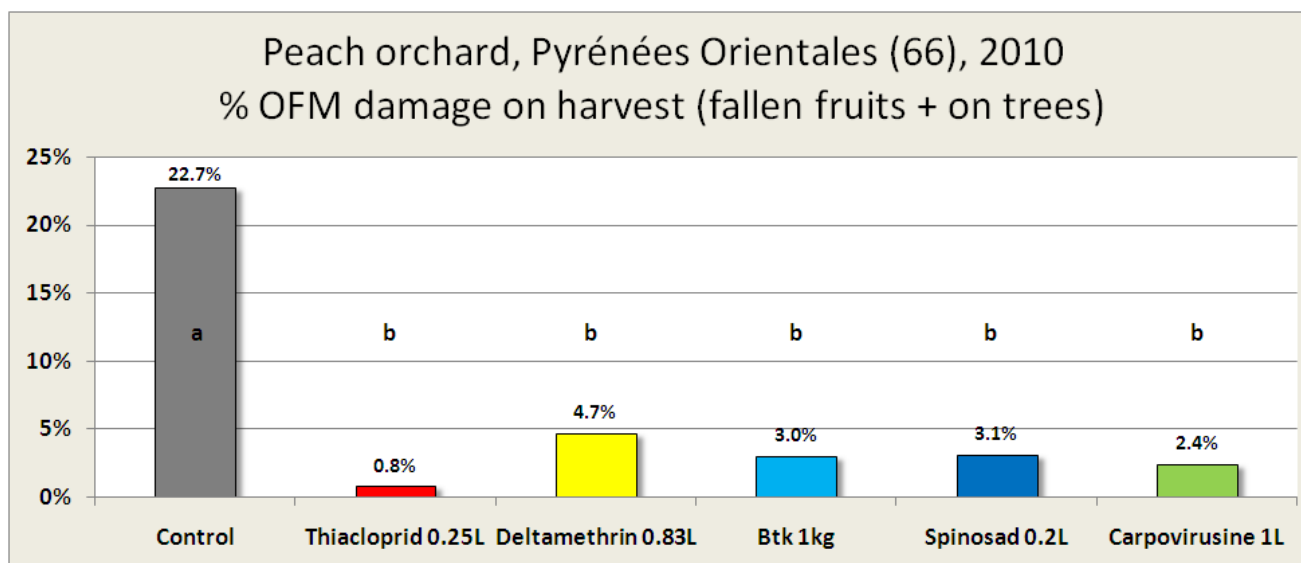
- Average efficacy of Carpovirusine 42% vs. 59% for Deltamethrin
- No statistical difference between treatments

# Development trials Italy, peach/nectarine



- Average efficacy of Carpovirusine 76% vs. 82% for Deltamethrin and 68% for BTK
- No statistical difference between treatments

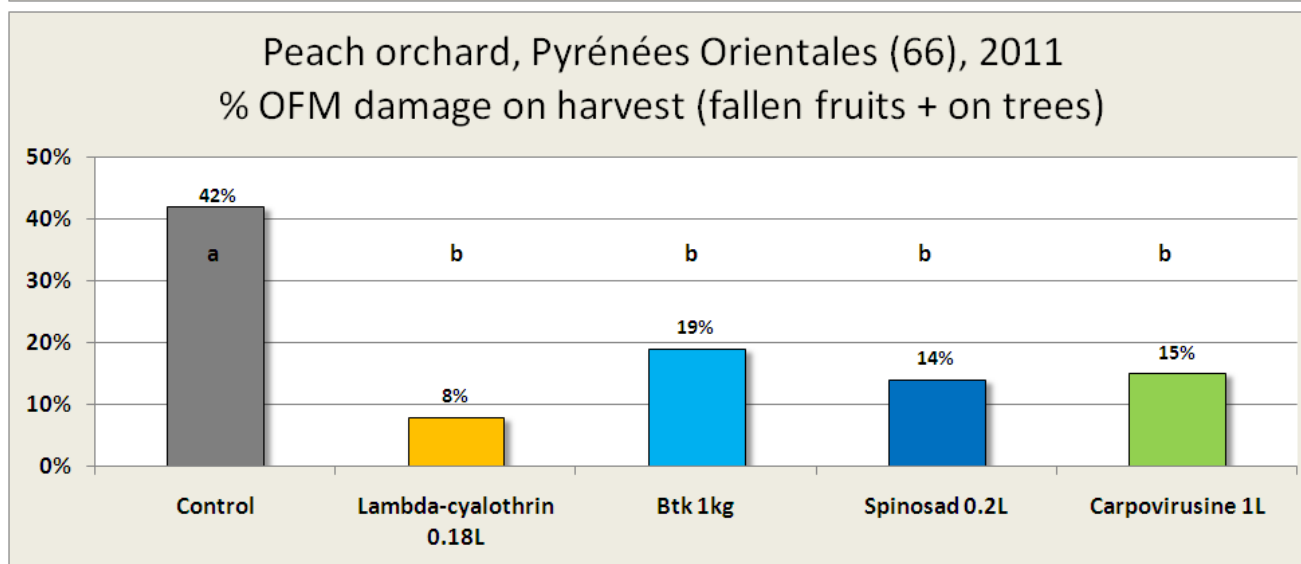
# Demonstration trials, peach, France, 2010 and 2011



Sponsor Arysta LifeScience

**2010 - medium pressure**

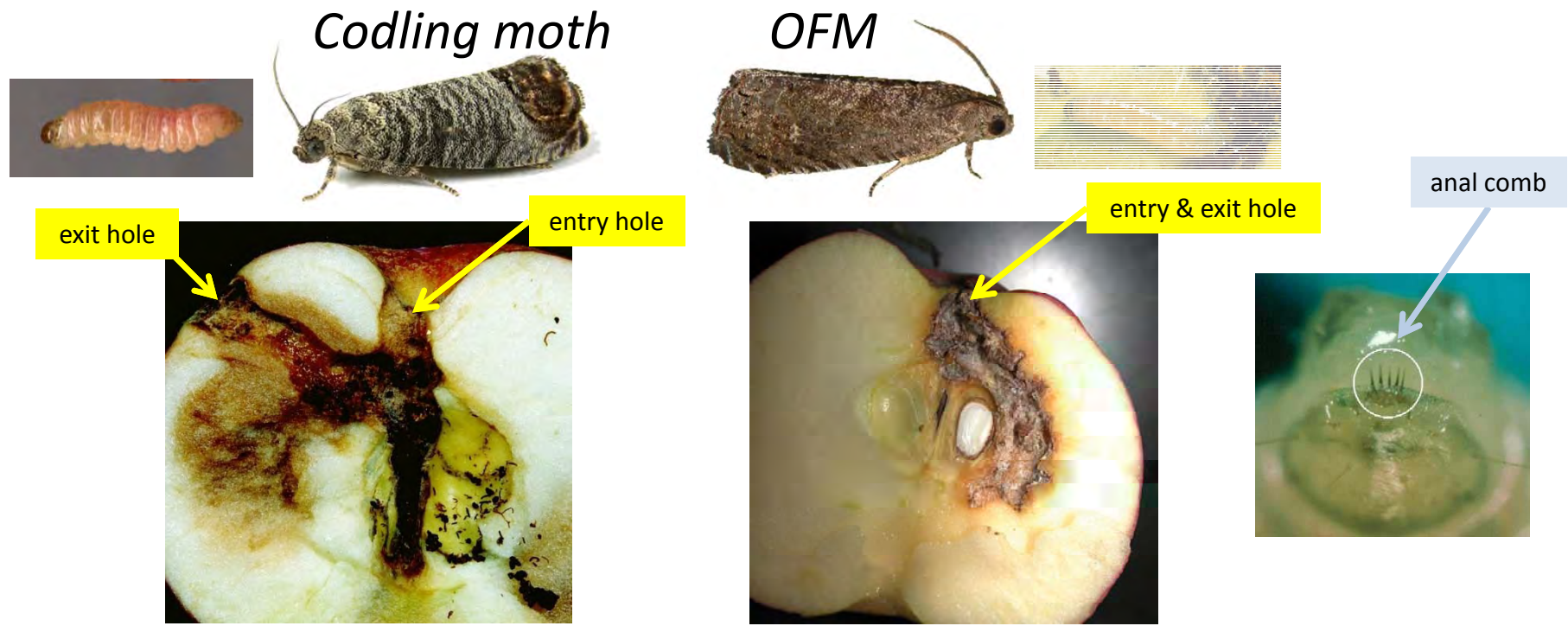
- Carpovirusine efficacy 89%
- Comparable to all treatments



**2011 - high pressure**  
*(same orchard)*

- Carpovirusine efficacy 64%
- Comparable to all treatments

# Complexity in apple and pear orchards

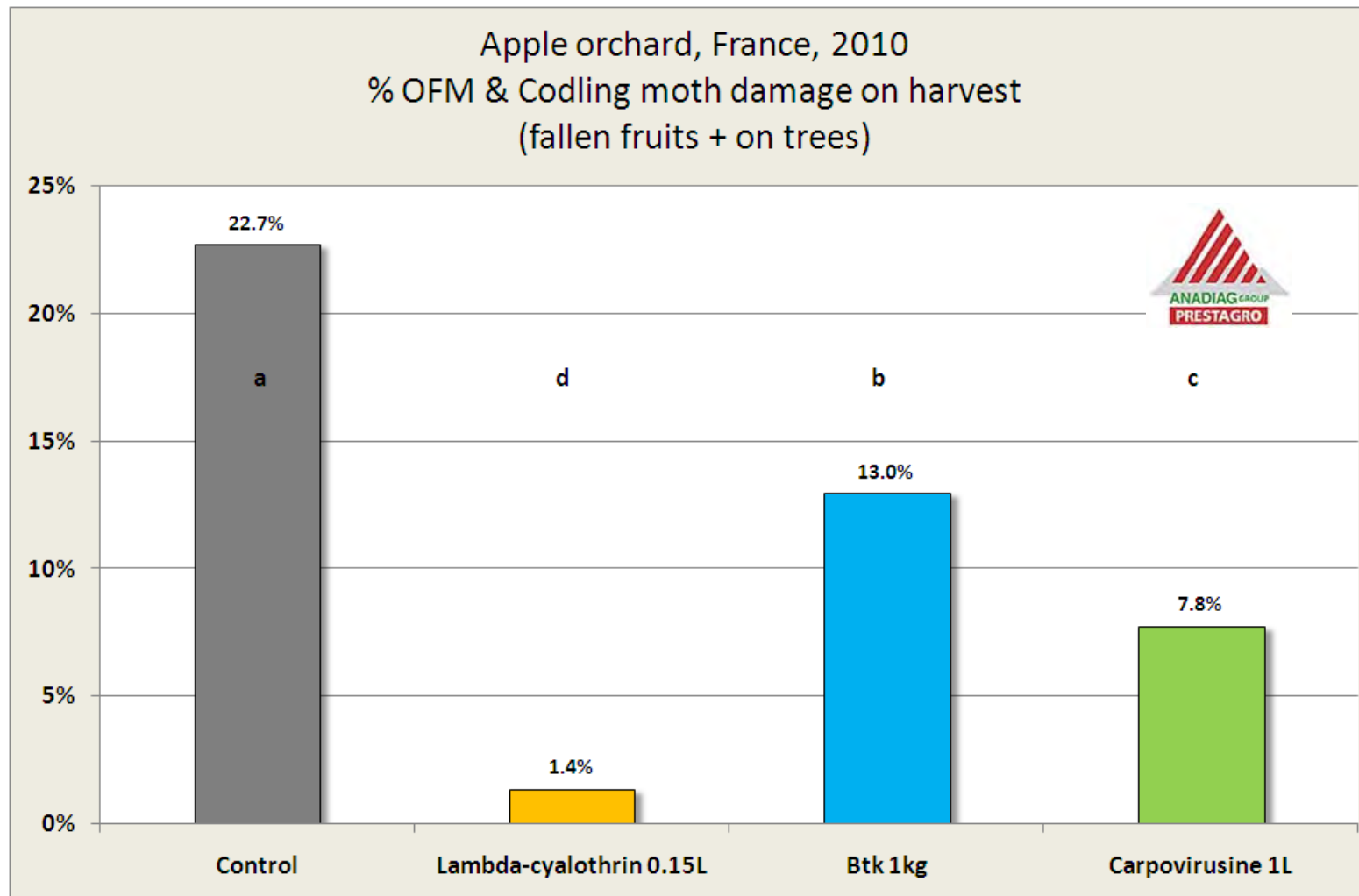


- Ratio Codling moth/OFM is multi-factorial dependent (weather, cultivar...)
  - CM and OFM adult and larvae look very similar
  - Damage on fruits are somehow different (entry hole vs. exit hole)
  - You can tell which is which only when it is too late to spray!
  - Binocular is necessary to strictly differentiate the pests
- Growers prefer to stop using CpGV

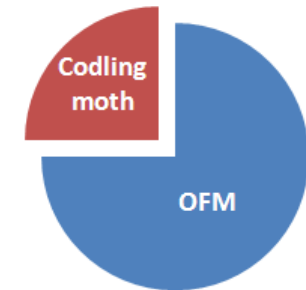
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# Development trials on apple

# Development trial France, apple

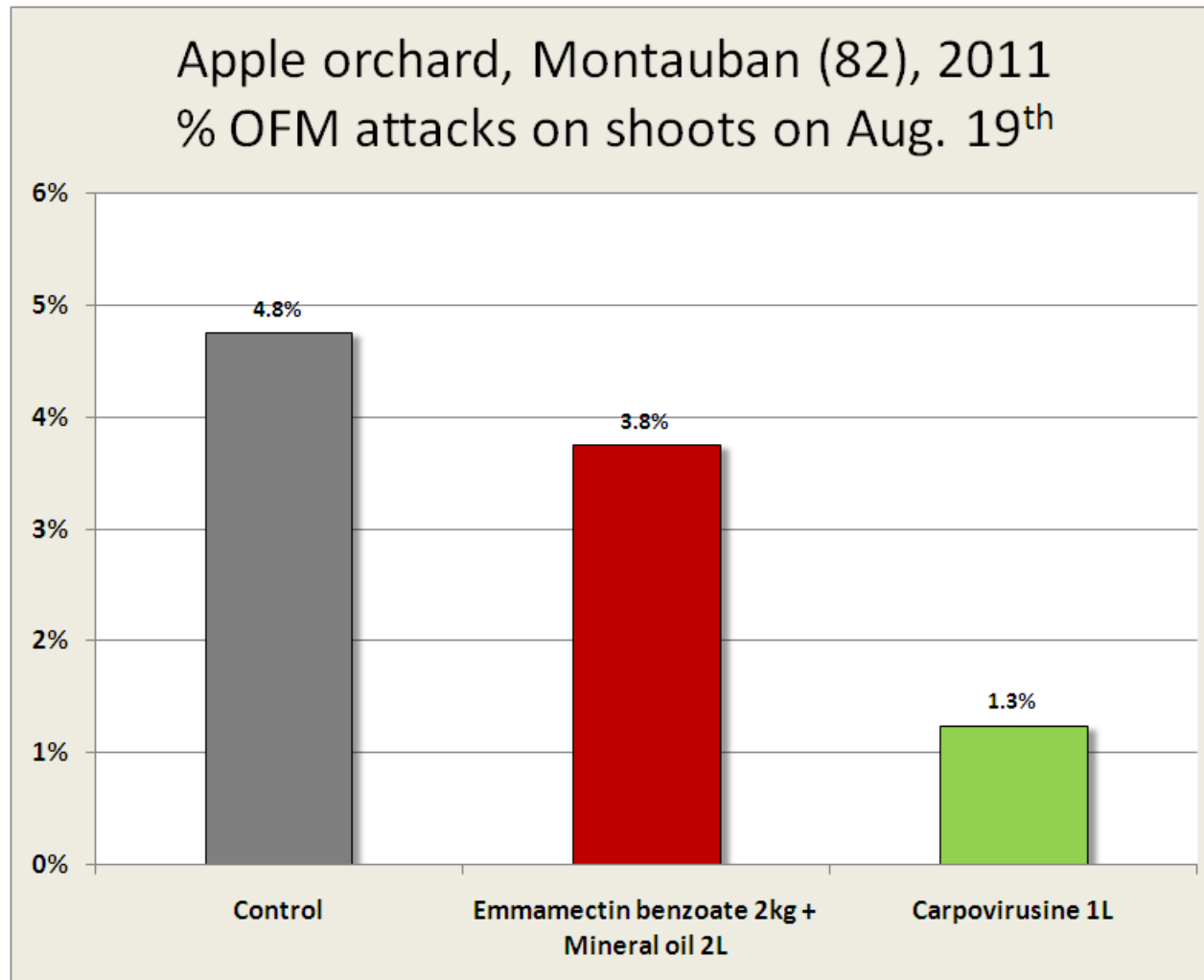


Larvae identification  
in untreated control



- High Codling moth and OFM pressure on harvest
- Considering Carpovirusine efficacy (66%) as well as larval identification in untreated fruits, demonstration is made that Carpovirusine is efficient on OFM in apple orchards

# Demonstration trial France, apple



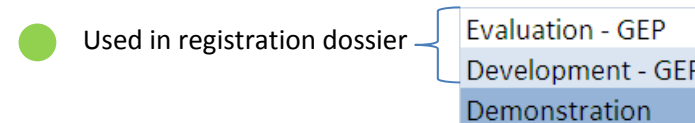
Contractor: CEFEL

Sponsor: Arysta

- Carpovirusine is more efficient than chemical reference
- No data on harvest due to 100% damage caused by CM



# List of trials



Year	Country	Place	Crop	Contractor	Chemical reference	Comment
● 2005	France	Barbentane (13)	Peach (Tendresse)	PROMO-VERT	Deltamethrin, Fenoxycarb + Lannate	<b>Efficacy of Carpovirusine (*)</b>
● 2007	France	Bize-Minervois (11)	Peach (Gladys)	AGROTEST	Deltamethrin	Efficacy of Carpovirusine (ns)
● 2007	France	Anjou (38)	Nectarine (Sun rise)	PRESTAGRO	Deltamethrin	<b>Efficacy of Carpovirusine (*)</b>
● 2008	France	Auberives sur Varèze (38)	Peach (Benedicte)	PRESTAGRO	Deltamethrin, Thiachlopid	<b>Efficacy of Carpovirusine (*)</b>
● 2008	France	Grans (13)	Nectarine (Caldesi)	PROMO-VERT	Deltamethrin, Thiachlopid	Efficacy of Carpovirusine (ns)
● 2008	France	Bize Minervois (11)	Peach (Gladys)	AGROTEST	Deltamethrin	Efficacy of Carpovirusine (ns)
● 2009	France	Bize-Minervois (11)	Peach (Gladys)	AGROTEST	Deltamethrin	<b>Efficacy of Carpovirusine (*)</b>
● 2009	Italy	Stocchetta (IT)	Peach (Maria bianca)	STAPHYT	Deltamethrin	<b>Efficacy of Carpovirusine (*)</b>
● 2009	Italy	Imola (IT)	Nectarine	STAPHYT	Deltamethrin	<i>Low pressure - trial discarded</i>
● 2009	Italy	Martorano di Cesena (IT)	Peach	STAPHYT	Deltamethrin	<i>Low pressure - trial discarded</i>
● 2009	France	Grans (13)	Peach (Lucie)	PRESTAGRO	Deltamethrinn, Btk	Efficacy of Carpovirusine (ns)
● 2010	Italy	CESENA	Peach	STAPHYT	Deltamethrinn, Btk	<b>Efficacy of Carpovirusine (*)</b>
● 2010	Italy	Arcagna	Peach	STAPHYT	Deltamethrinn, Btk	<b>Efficacy of Carpovirusine (*)</b>
● 2010	Italy	Ravenna	Nectarine	STAPHYT	Deltamethrinn, Btk	<b>Efficacy of Carpovirusine (*)</b>
● 2010	France	Lafitte sur Lot (47)	Apple (Galaxi)	PRESTAGRO	Lambda-cyhalothrin, Btk	<b>Efficacy of Carpovirusine (*)</b>
2010	France	Pyrénées Orientales (66)	Peach	Chambre Agr. 66	Deltamethrin, Thiachlopid, Btk, Spinosad	<b>Efficacy of Carpovirusine (*)</b>
2011	France	Pyrénées Orientales (66)	Peach	Chambre Agr. 66	Lambda-cyhalothrin, Btk, Spinosad	<b>Efficacy of Carpovirusine (*)</b>
2011	France	Montauban (82)	Apple (Granny Smith)	CEFEL	Emmamectin benzoate	<b>Efficacy of Carpovirusine (*)</b>

- Arysta set up 18 ‘randomized small-plot’ trials on OFM with Carpovirusine (FR, IT)
- 15 of them are official, GEP trials
- 13 of them clearly demonstrate Carpovirusine efficacy (9 \* / 4 ns) → registration
- All those trials (13) + 3 demo trials are presented here

# OFM products toolbox 2011, France

peach	apple	Trademark	Active ingredient	Max.	PHI	ZNT	dose/ha
X	X	Calypso <sup>Bayer</sup>	Thiacloprid	2	14	50	0.25
X	X	Décis Protech <sup>Bayer</sup>	Deltamethrin	3	3 (7)	50	0.83
X	X	Affirm <sup>Syngenta</sup> <b>new</b>	Emamectine benzoate	3	7 (3)	50	2.00
X	X	Coragen <sup>DuPont</sup> <b>new</b>	Chlorantraniliprole (rynaxypyr)	1	14	20	0.18
X	X	Karate Zeon <sup>Syngenta</sup>	Lambda-cyhalothrin	-	7	-	0.18
X		Insegar <sup>Syngenta</sup>	Fenoxycarbe	2	14	-	0.30
X		Steward <sup>DuPont</sup> <b>new</b>	Indoxacarb	4	7	20	0.17
X		Success 4 <sup>Dow</sup>	Spinosad	2	7	50	0.20
X	X	Isomate-OFM <sup>Sumi-Agro</sup> <b>new</b>	Mating disruption	-	-	-	500
X		Rak 5 <sup>BASF</sup>	Mating disruption	-	-	-	500
(X)	(X)	Carpovirusine <sup>Arysta</sup> <b>2012</b>	CpGV	-	3	-	1.0
X	X	Delfin <sup>Certis</sup>	Btk 3a 3b	-	3	-	1.0

- Many new specialties against OFM in France in 2011
- Toolbox against OFM is larger on peach/nectarine than on apple/pear
- Broad spectrum chemical specialties have stronger and stronger restrictions of use (number of sprays per season, pre-harvest intervals (DAR), minimum buffer distance (ZNT))
- Alternative solutions (in green) are becoming more and more essential in many orchards, especially close to harvest time

# Conclusion

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- Carpovirusine – CpGV M – efficacy on OFM
  - Is at least similar as that of other Biocontrol products (Bt, Spinosad)
  - Is somehow comparable to that of chemical insecticides
  - Is comparable to that of Carpovirusine on Codling moth
- Carpovirusine is a new – residue free – solution for OFM control in peach, nectarine and apple orchards
  - In organic farming
  - In IPM, to be used in a program with chemical insecticides
- Business-wise, this innovation will
  - Open the core-fruits market
  - Secure Carpovirusine sales in South of France and Italy
  - Reinforce its role as an alternative to chemicals in IPM programs
  - Confirm Arysta as a solution provider for sustainable agriculture

# Thank you for your attention!

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