



Imidacloprid contaminates the pollen of seed-coated crops : A high risk for bees

BEE HEALTH COMMISSION - PLENARY SESSION

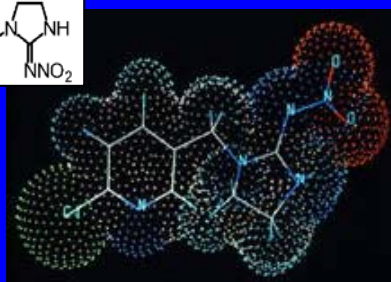
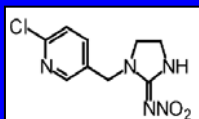
“Has beekeeping a future : new challenges or bee health”

Friday 18th afternoon

Chair : Wolfgang RITTER

Dr J.-M. BONMATIN, Centre de Biophysique Moléculaire, CNRS Orléans, France

Honeybees & imidacloprid



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Commercial :
Gaucho, Confidor, Férial Advantage, Provado, etc.

France :

Gaucho	1994
suspended /sunflower	1999
suspended /maize	2004

Doses ~ 50 à 100 g/ha

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All derivatives then lead to the toxic 6-chloronicotinic acid

nitroso

monohydroxy (x 2)

olefine

dihydroxy

guanidine

guanidine-olefine

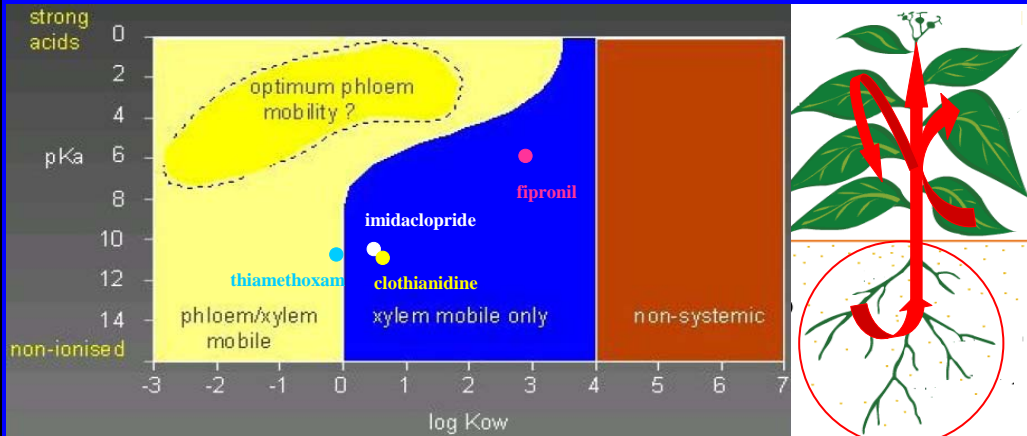
urea

Imidacloprid

Nauen et al., Pestic. Sci. 1998
Oliveira et al., J. Environ. Sci. Health 2000

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Systemic Insecticides : Xylemic and phloemic transport



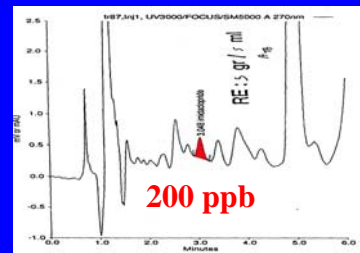
Bromilow, R.H., Chamberlain, K. & Evans, A.A. (1990) *Weed Science*, 38, 305-314.

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Analytics

• BAYER 1993
HPLC/UV

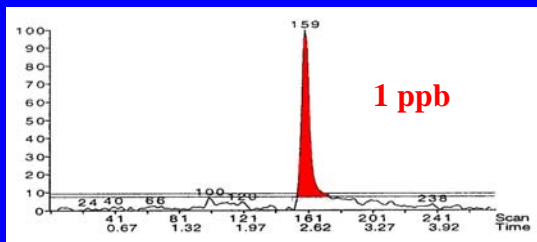


• CNRS 2003

HPLC/MS/MS + Directive 96/23 CE, GLP, QC

LOD = 0.1 ppb

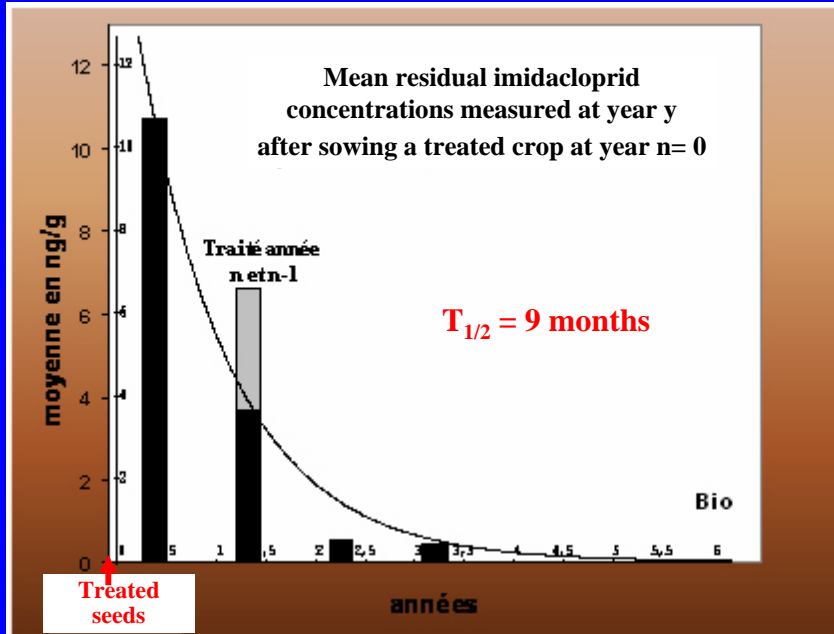
LOQ = 1 ppb



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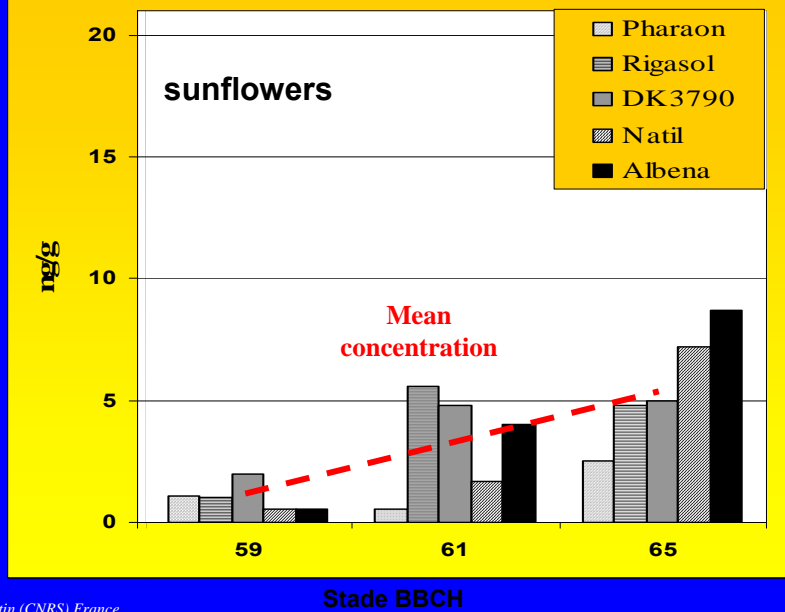
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Remains in soils after harvesting (sunflower)



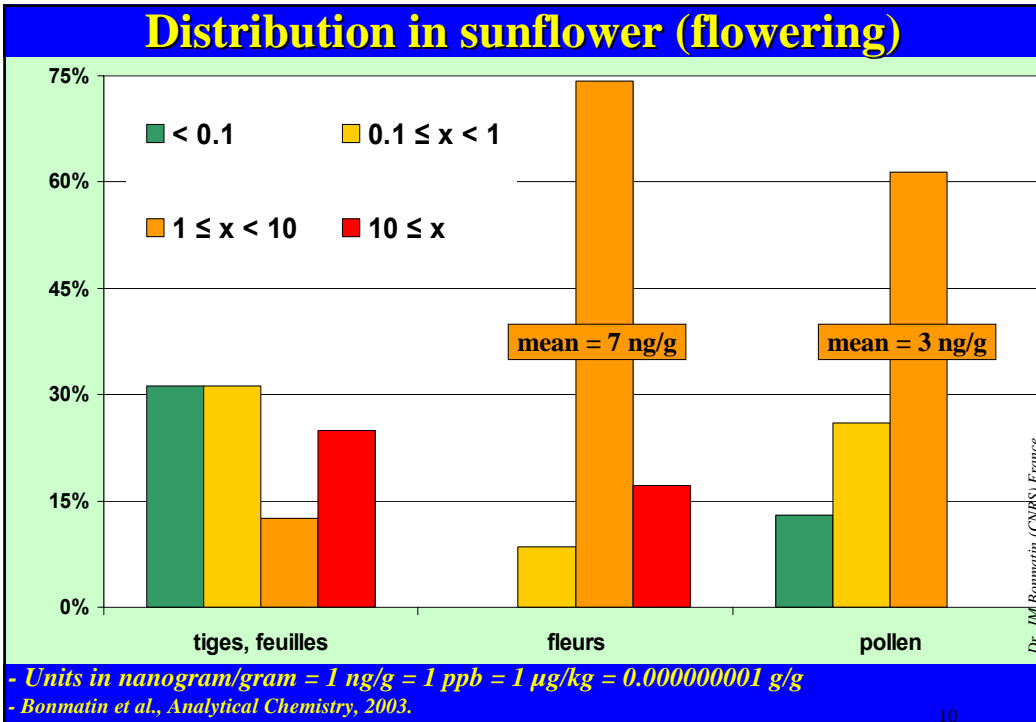
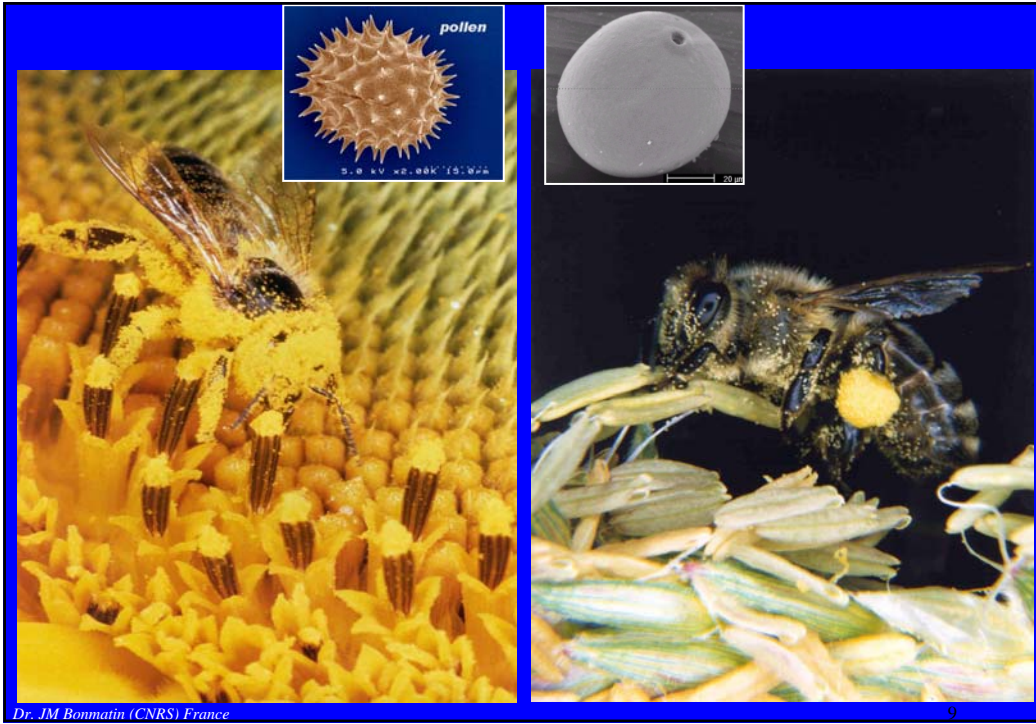
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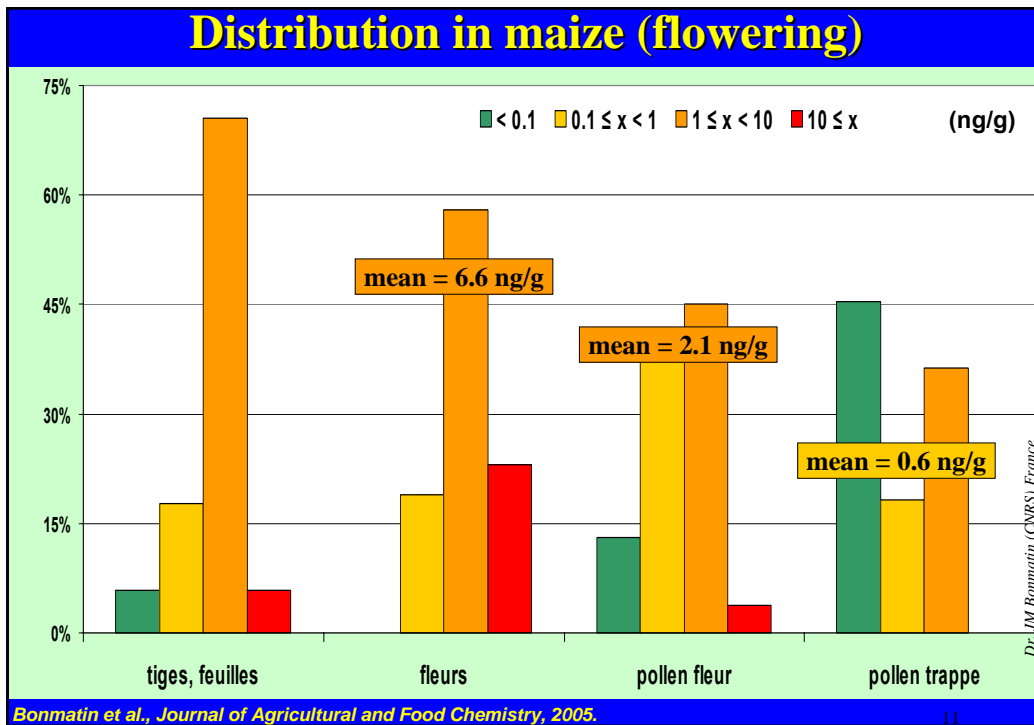
Imidacloprid uptake in flowers



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Canola (USA)

Trapped pollen :

Nectar :

(Scott-Dupree & Spivak, 2000)

3.1 < mean < 3.5 ppb

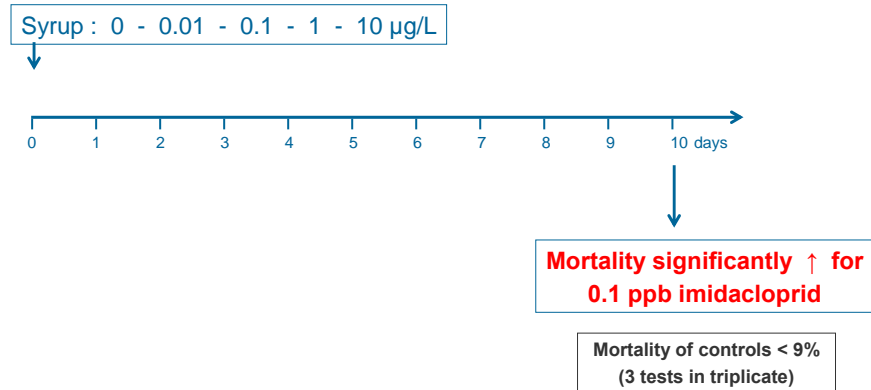
0.5 < mean < 0.8 ppb

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Subchronic Toxicity

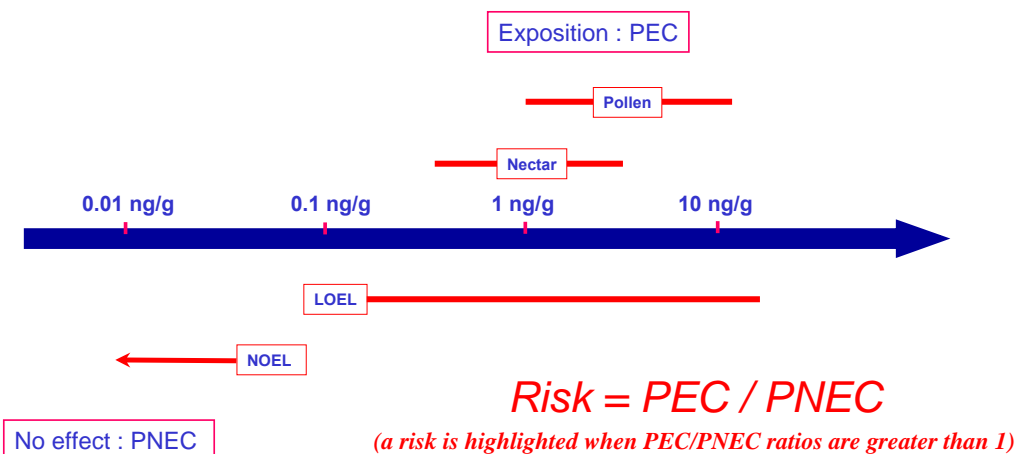


Exposition of bees to imidacloprid far under the LD50 (4 ng/bee):



Dr. L. Belzunces (INRA) France

Effects of imidacloprid on bees : Risk assessment



Dr. JM Bonmatin (CNRS) France, Dr Colin (SupAgro) France & Dr. L. Belzunces (INRA) France

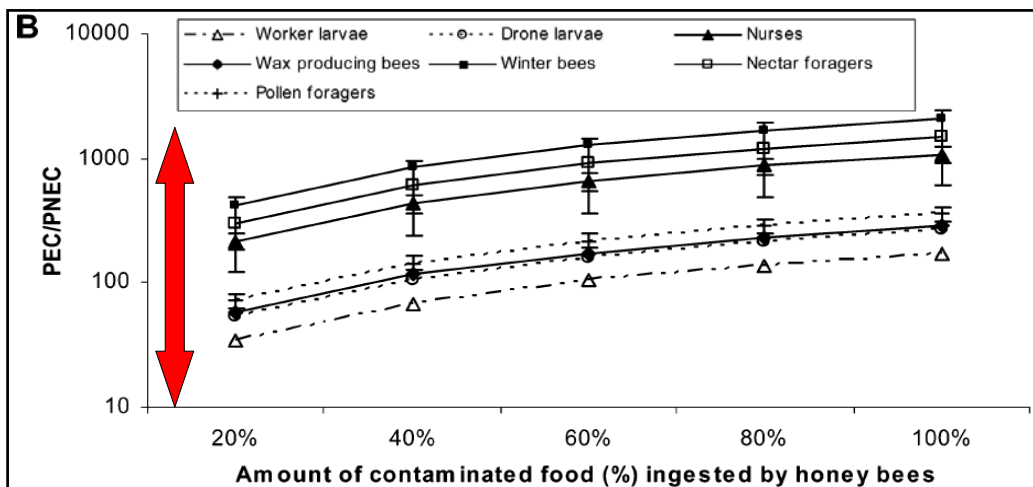


FIGURE 1. Hazard posed by **imidacloprid** to different categories of honey bees feeding on various proportions of contaminated food: estimated PEC/PNEC ratios derived from (B) **chronic toxicity** data, obtained in **field conditions for foragers** and in laboratory conditions for all the other categories of honey bees (a risk is highlighted when PEC/PNEC ratios are greater than 1).

- *Comité Scientifique et Technique (CST) du trouble des abeilles, 2003 (on line)*

- *Halm et al., Environ. Sci. Technol. 2006, 40, 2448-2454.*

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Conclusion

Imidacloprid (Gaucho) :

- *A long persistence / soils ($t_{1/2} = 9$ months)*
- *An uptake in flowers (mean level at 7 ng/g)*
- *Mean level at 2-3 ng/g in pollen*
- *Sublethal effects at 2-4 ng/g (4 days)*
- *Chronic mortality from 0.1 ng/g (10 days)*
- *Main metabolites as much toxic as imidacloprid for bees*
- *High risk for the beehives (PEC/PNEC $\gg 1$)*
- *Synergies with other pesticides, pathogens and parasites*
- *Generalization of these results to nicotinoids and pyrazoles (clothianidin, thiamethoxam, fipronil...)*

Our références:

- Bonmatin, J.M., Marchand, P.A., Charvet, R., Moineau, I., Bengsch, E.R. & Colin, M.E. (2005) *J. Agric. Food Chem.* 53, 5336-5341.
- Charvet, R., Katouzian-Safadi, M., Colin, M.E., Marchand, P.A., Bonmatin, J.M. (2004) *Annal. Pharm. Fr.* 62, 29-35.
- Colin, M.E., Bonmatin, J.M., Moineau, I., Galmon, C., Brun, S. & Vermandère, J.P. (2004) *Arch. Environ. Cont. Toxicol.* 47, 387-395.
- Bonmatin, J.M., Marchand, P.A., Charvet, R. & Colin, M.E. (2004) *Eurbee 1*, (on line: <http://web.uniud.it/eurbee/>)
- Bonmatin, J.M., Moineau, I., Charvet, R., Fléché, C., Colin, M.E. & Bengsch, E.R. (2003) *Anal. Chem.* 75, 2027-2033.
- Bonmatin, J.M. (2002) *Sciences 2*, 42-46.



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Collaborators

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