ipbes

UNEP

Press Release: Pollinators Vital to Our Food Supply Under Threat

http://www.ipbes.net/article/press-release-pollinators-vital-our-food-supply-under-threat

By the numbers

- 20,000 – Number of species of wild bees. There are also some species of butterflies, moths, wasps, beetles, birds, bats and other vertebrates that contribute to pollination.
- 75% – Percentage of the world's food crops that depend at least in part on pollination.
- US$235 billion–US$577 billion – Annual value of global crops directly affected by pollinators.
- 300% -- Increase in volume of agricultural production dependent on animal pollination in the past 50 years.
- Almost 90% -- Percentage of wild flowering plants that depend to some extent on animal pollination.
- 1.6 million tonnes – Annual honey production from the western honeybee.
- 16.5% -- Percentage of vertebrate pollinators threatened with extinction globally.
- +40% – Percentage of invertebrate pollinator species – particularly bees and butterflies – facing extinction.

ipbes

UNEP

Press Release: Pollinators Vital to Our Food Supply Under Threat

http://www.ipbes.net/article/press-release-pollinators-vital-our-food-supply-under-threat

Various factors affecting pollinators

"Wild pollinators in certain regions, especially bees and butterflies, are being threatened by a variety of factors," said IPBES Vice-Chair, Sir Robert Watson. "Their decline is primarily due to changes in land use, intensive agricultural practices and pesticide use, alien invasive species, diseases and pests, and climate change."

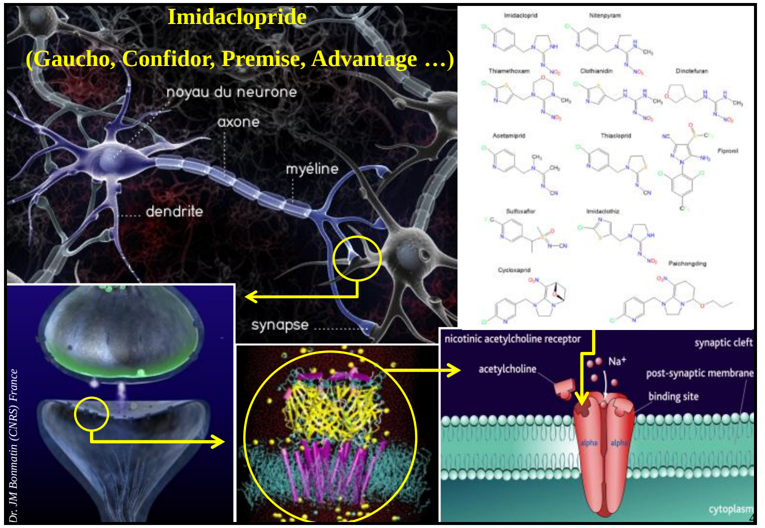
The assessment found that pesticides, including neonicotinoid insecticides, threaten pollinators worldwide, although the long-term effects are still unknown. A pioneering study conducted in farm fields showed that one neonicotinoid insecticide had a negative effect on wild bees, but the effect on managed honeybees was less clear.

Numerous options exist to safeguard pollinators

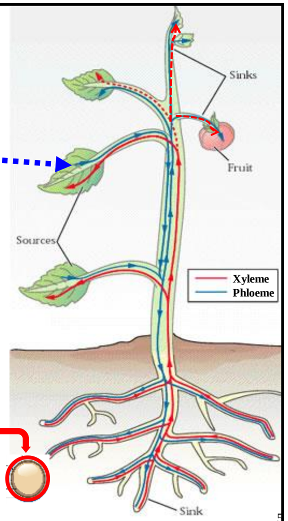
- Decreasing exposure of pollinators to pesticides by reducing their usage, seeking alternative forms of pest control, and adopting a range of specific application practices, including technologies to reduce pesticide drift; and

Imidaclopride

(Gaucho, Confidor, Premise, Advantage …)



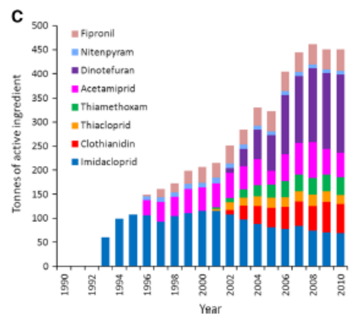
Translaminaire & systémique (~ 0,1 kg/ha)



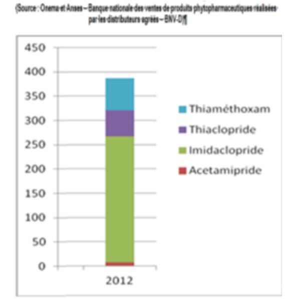
Systémique (~ 0,1 kg/ha)

Croissance du marché

Japon

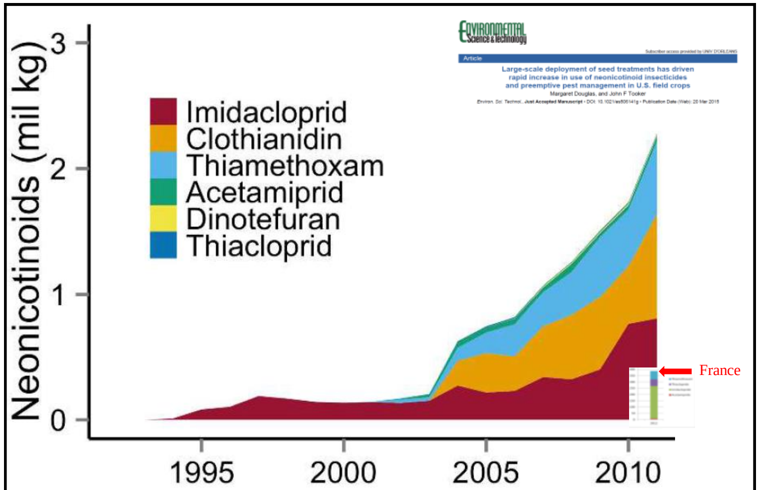


France



Utilisation préventive & massive + multiplicité des toxiques

Imidaclopride en France:	260 tonnes en 2012	
	269 tonnes en 2013	(+ 4%)
	367 tonnes en 2014	(+ 36%)



Environ Sci Pollut Res
DOI 10.1007/s11356-014-3471-x

WORLDWIDE INTEGRATED ASSESSMENT OF THE IMPACT OF SYSTEMIC PESTICIDES ON BIODIVERSITY AND ECOSYSTEMS

Effects of neonicotinoids and fipronil on non-target invertebrates

Acute toxicity to honeybees

pesticide	®	Use	Dose g/ha	LD50 ng/ab	Tox/DDT
DDT	Dinocide	insecticide	200-600	27 000.0	1
thiaclopride	Proteus	insecticide	62,5	12 600.0	2.1
amitraze	Apivar	acaricide	-	12 000.0	2.3
acetamiprid	Supreme	insecticide	30-150	7 100.0	3.8
coumaphos	Perizin	acaricide	-	3 000.0	9
methiocarb	Mesurol	insecticide	150-2200	230.0	117
tau-fluvalinate	Apistan	acaricide	-	200.0	135
carbofuran	Curater	insecticide	600	160.0	169
λ-cyhalothrine	Karate	insecticide	150	38.0	711
thiaméthoxam	Cruiser	insecticide	69	5.0	5 400
fipronil	Regent	insecticide	50	4.2	6 475
imidaclopride	Gaucho	insecticide	75	3.7	7 297
clothianidine	Poncho	insecticide	50	2.5	10 800
deltamethrine	Décis	insecticide	7,5	2.5	10 800

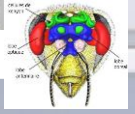
& lethal and subletal effects from 0.1 ng/g in food resources by chronic exposure

1 ng de toxique / g de pollen = 0,000 000 001 g/g

CNRS : détection à 0,2 ng/g

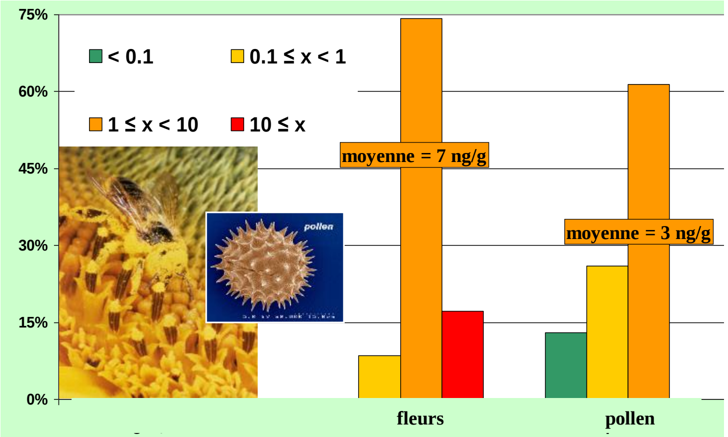
/

1 ng/g ↔ 2 343 750 000 de molécules d'imidaclopride dans le cerveau d'une abeille



Imidaclopride et tournesol (floraison)

(Bonmatin et al. Analytical Chemistry, 2003)



Exemple d'exposition réelle par le nectar (miel frais)

(Vendée printemps 2009 & 2010 : 2 ruchers x 3 ruches, prélèvements tous les 15 jours)

Insecticide	Niveau max (ng/g)	LMR (CE) (ng/g)
Acrinathrin	Not detected	50
Bifenthrin	Not detected	-
Cypermethrin	Not detected	50
Deltamethrin	**3.6**	**30**
Esfenvalerate	Not detected	-
~~Fipronil~~	Not detected	10
~~Fipronil desulfinyl~~	Not detected	10
~~Fipronil sulfide~~	Not detected	10
~~Fipronil sulfone~~	Not detected	10
λ-cyhalothrin	Not detected	20
Permethrin	Not detected	-
Pyraclofos	Not detected	-
Resmethrin	Not detected	-
Tebufenpyrad	Not detected	50
τ-fluvalinate	**69.2**	**10**
Tolfenpyrad	Not detected	-
Acetamiprid	**112.8**	**50**
~~Clothianidin~~	Not detected	10
Ethiprole	Not detected	-
~~Imidacloprid~~	Not detected	50
Thiacloprid	**11.6**	**50**
Thiamethoxam	**2.0**	**10**

Anal Bioanal Chem (2014) 406:621–633
DOI 10.1007/s00216-013-7483-z

RESEARCH PAPER

Sensitive analytical methods for 22 relevant insecticides of 3 chemical families in honey by GC-MS/MS and LC-MS/MS

Delphine Paradis · Géraldine Bérail · Jean-Marc Bonmatin · Luc P. Belzunces

„Alle Dinge sind ein Gift und nichts ist ohne Gift. Allein die Dosis macht, daß ein Ding kein Gift ist."

Tout est poison, rien n'est sans poison. Seule la dose fait qu'une chose n'est pas un poison.
(Paracelse, 1537)

Mais la toxicologie a démontré nombre de cas contraires (ex: perturbateurs endocriniens)

Journal of Environmental & Analytical Toxicology

Tennekes, J Environ Anal Toxicol 2016, 6:5
DOI: 10.4172/2161-0525.1000408

Mini Review | Open Access

A Critical Appraisal of the Threshold of Toxicity Model for Non-Carcinogens

Henk A Tennekes*

Experimental Toxicology Services (ETS) Nederland BV, Frankensteeg 4, 7201KN Zutphen, The Netherlands

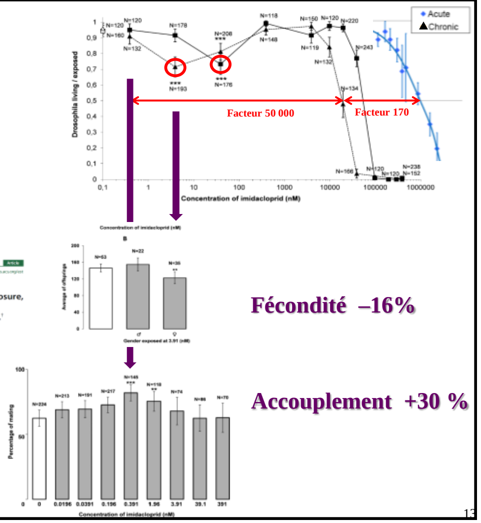
Abstract

Most regulatory agencies assume that there is no safe level of exposure to carcinogens but that a threshold, or "safe" exposure level exists for non-carcinogens. However, recent discoveries have cast serious doubt on the validity of this concept. Five examples of non-carcinogens without an apparent threshold (neonicotinoids, dioxin, dieldrin, endocrine disruptors, and sulfhydryl-reactive metals) are presented. It is also clear by now that the threshold model for non-carcinogens may seriously underestimate actual risk. Risk assessments can no longer assume thresholds for non-carcinogens when the shape of the dose-response curve is linear at low concentrations. Risk management of such chemicals should be based on the ALARA principle ("as low as reasonably achievable").

ENVIRONMENTAL Science & Technology

Lethal and Sublethal Effects of Imidacloprid, After Chronic Exposure, On the Insect Model *Drosophila melanogaster*

Gail Charpentier, Fanny Louat, Jean-Marc Bonmatin, Patrice A. Marchand, Fanny Vanier, Daniel Locker, and Martine Decoville

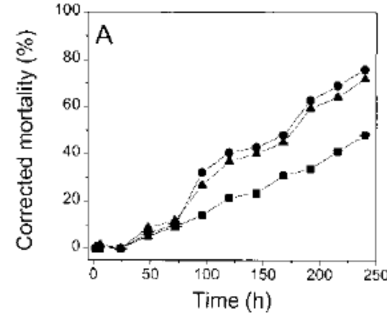


Fécondité –16%

Accouplement +30 %

S. Suchail et al. *Environ. Toxicol. Chem.* 20, 2001

Fig. 2. Mortality kinetics in *Apis mellifera* during chronic exposure to imidacloprid



0,1 ng/g

Worldwide integrated assessment on systemic pesticides

Global collapse of the entomofauna: exploring the role of systemic insecticides

2014: eight scientific papers (154 pages)

- **Five years study**
- **First meta-analysis on neonicotinoids and fipronil**
- **29 scientific authors (no conflict of interest)**
- **Comprehensive analysis (> 1100 publications & data from companies)**
- **Published in *Environmental Science and Pollution Research***

DOI: 10.1007/s11356-014-3220-1 DOI: 10.1007/s11356-014-3470-y
DOI: 10.1007/s11356-014-3180-5 DOI: 10.1007/s11356-014-3277-x
DOI: 10.1007/s11356-014-3332-7 DOI: 10.1007/s11356-014-3471-x
DOI: 10.1007/s11356-014-3628-7 DOI: 10.1007/s11356-014-3229-5

2017-2018: three scientific papers (107 pages)

- **Updated meta-analysis on neonicotinoids and fipronil**
- **24 scientific authors (no conflict of interest)**
- **Comprehensive analysis (> 700 publications)**
- **3 main chapters:**
  - Exposures & Metabolism DOI: 10.1007/s11356-017-0394-3
  - Impacts & Ecosystems DOI: 10.1007/s11356-017-0341-3
  - Resistances & Alternatives DOI: 10.1007/s11356-017-1052-5

The Task Force on Systemic Pesticides WWW.TFSP.INFO

Objectif : évaluation des risques et mesure des impacts pour les espèces non-ciblées

Mesure des expositions réelles
- plantes (dont pollen & nectar)
- sol (pollution et devenir)
- eau (de surface et profondes)
- air (dont poussières)

Mesure des effets réels
- Toxicité aiguë (e.g. DL50)
- effets chroniques (sur 10 jours)
- en laboratoire
- sous tunnel ou en plein champ

Risque = Concentration réelle d'exposition / Concentration la plus basse ayant des effets (LOEC)

Recommandations aux autorités pour la protection des pollinisateurs, des écosystèmes et de la santé publique

Environ Sci Pollut Res
DOI 10.1007/s11356-014-3332-7

WORLDWIDE INTEGRATED ASSESSMENT OF THE IMPACT OF SYSTEMIC PESTICIDES ON BIODIVERSITY AND ECOSYSTEMS

Environmental fate and exposure; neonicotinoids and fipronil

J.-M. Bonmatin · C. Giorio · V. Girolami · D. Goulson · D. P. Kreutzweiser · C. Krupke · M. Liess · E. Long · M. Marzaro · E. A. D. Mitchell · D. A. Noome · N. Simon-Delso · A. Tapparo

Exemple de contamination généralisée : imidaclopride (valeurs moyennes):

- Sols : 1 ng/g - 1000 ng/g
  (organic farming < 0.01 ng/g)
- Eaux profondes : 1 - 100 ng/L
- Eaux de surface: 1 - 2000 ng/L
- Poussières: 1 – 30 µg/m^3
- Cultures: 1 - 1000 ng/g
- Fruits & légumes : 1 - 100 ng/g
- Pollen : 1 - 39 ng/g   Miel : 1 - 73 ng/g
- Abeilles mortes : de 0 (metabolisé) à 5 ng/g (LOEC = 0.1 ng/g)

Neonicotinoid	DT50 soil (days)	Max (years)
Acetamiprid	1-450	1.5
Clothianidin	148-6900	30
Dinotefuran	75-138	0.5
Imidacloprid	40-1136	5
Thiacloprid	1-27	3
Thiamethoxam	25-100	1

PNAS PNAS PNAS

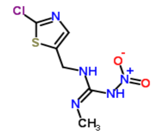
Neonicotinoid clothianidin adversely affects insect immunity and promotes replication of a viral pathogen in honey bees

Gennaro Di Prisco[a], Valeria Cavaliere[b], Desiderato Annoscia[c], Paola Varricchio[a], Emilio Caprio[a], Francesco Nazzi[c], Giuseppe Gargiulo[b], and Francesco Pennacchio[a,1]

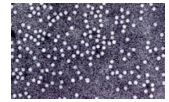
[a]Dipartimento di Agraria, Laboratorio di Entomologia E. Tremblay, Università degli Studi di Napoli Federico II, I-80055 Portici, Italy; [b]Dipartimento di Farmacia e Biotecnologie, Università di Bologna, I-40126 Bologna, Italy; and [c]Dipartimento di Scienze Agrarie e Ambientali, Università degli Studi di Udine, I-33100 Udine, Italy

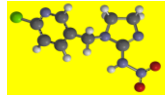
Edited by Gene E. Robinson, University of Illinois at Urbana–Champaign, Urbana, IL, and approved October 1, 2013 (received for review August 8, 2013)

Large-scale losses of honey bee colonies represent a poorly understood problem of global importance. Both biotic and abiotic factors are involved in this phenomenon that is often associated with high loads of parasites and pathogens. A stronger impact of pathogens in honey bees exposed to neonicotinoid insecticides has been reported, but the causal link between insecticide exposure and the possible immune alteration of honey bees remains elusive. Here, we demonstrate that the neonicotinoid insecticide clothianidin negatively modulates NF-κB immune signaling in insects and adversely affects honey bee antiviral defenses controlled by this transcription factor. We have identified in insects a negative modulator of NF-κB activation, which is a leucine-rich repeat protein. Exposure to clothianidin, by enhancing the transcription of the gene encoding this inhibitor, reduces immune defenses and promotes the replication of the deformed wing virus in honey bees bearing covert infections. This honey bee immunosuppression is similarly induced by a different neonicotinoid, imidacloprid, but not by the organophosphate chlorpyriphos, which does not affect NF-κB signaling. The occurrence at sublethal doses of this insecticide-induced viral proliferation suggests that the



Clothianidin + DWV





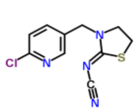
Imidacloprid + DWV

OPEN ACCESS Freely available online   PLoS one

Exposure to Sublethal Doses of Fipronil and Thiacloprid Highly Increases Mortality of Honeybees Previously Infected by *Nosema ceranae*

Cyril Vidau[1,2], Marie Diogon[1,2], Julie Aufauvre[1,2], Régis Fontbonne[1,2], Bernard Viguès[1,2], Jean-Luc Brunet[3], Catherine Texier[2], David G. Biron[1,2], Nicolas Blot[1,2], Hicham El Alaoui[1,2], Luc P. Belzunces[3], Frédéric Delbac[1,2*]

1 Clermont Université, Université Blaise Pascal, Laboratoire Microorganismes: Génome et Environnement, BP 10448, Clermont-Ferrand, France, 2 CNRS, UMR 6023, LMGE, Aubière, France, 3 INRA, UMR 406 Abeilles & Environnement, Laboratoire de Toxicologie Environnementale, Site Agroparc, Avignon, France



Abstract

Background: The honeybee, *Apis mellifera*, is undergoing a worldwide decline whose origin is still in debate. Studies performed for twenty years suggest that this decline may involve both infectious diseases and exposure to pesticides. Joint action of pathogens and chemicals are known to threaten several organisms but the combined effects of these stressors were poorly investigated in honeybees. Our study was designed to explore the effect of *Nosema ceranae* infection on honeybee sensitivity to sublethal doses of the insecticides fipronil and thiacloprid.

Methodology/Finding: controls, (ii) infected wi infected with *N. cerana* 10 days p.i. to thiaclop content was evaluated infected honeybees we opposite effects on mic that *N. ceranae* infectio ethoxycoumarin-O-deet

Conclusions/Significan *ceranae*-infected honey mortality, however, did hypothesis that the co contribute to colony de

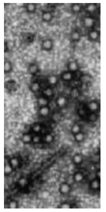
Citation: Vidau C, Diogon M, Au Honeybees Previously Infected b
Editor: Elizabeth Didier, Tulane
Received March 16, 2011; Acc

environmental microbiology   sfam society for applied microbiology
Environmental Microbiology (2014)   doi:10.1111/1462-2920.12426

Bees under stress: sublethal doses of a neonicotinoid pesticide and pathogens interact to elevate honey bee mortality across the life cycle

Vincent Doublet,[1*†] Maureen Labarussias,[1] Joachim R. de Miranda,[2] Robin F. A. Moritz[1,3] and Robert J. Paxton[1,3,4]

Thiacloprid + nosema
Thiacloprid + BQCV



Neonicotinoid-Coated *Zea mays* Seeds Indirectly Affect Honeybee Performance and Pathogen Susceptibility in Field Trials

Mohamed Alburaki[1,3*], Sébastien Boutin[1], Pierre-Luc Mercier[1,3], Yves Loublier[3], Madeleine Chagnon[4], Nicolas Derome[1,2]

PLOS ONE | DOI:10.1371/journal.pone.0125790   May 18, 2015

Abstract

Thirty-two honeybee (*Apis mellifera*) colonies were studied in order to detect and measure potential *in vivo* effects of neonicotinoid pesticides used in cornfields (*Zea mays* spp) on honeybee health. Honeybee colonies were randomly split on four different agricultural cornfield areas located near Quebec City, Canada. Two locations contained cornfields treated with a seed-coated systemic neonicotinoid insecticide while the two others were organic cornfields used as control treatments. Hives were extensively monitored for their performance and health traits over a period of two years. Honeybee viruses (brood queen cell virus BQCV, deformed wing virus DWV, and Israeli acute paralysis virus IAPV) and the brain specific expression of a biomarker of host physiological stress, the Acetylcholinesterase gene AChE, were investigated using RT-qPCR. Liquid chromatography-mass spectrometry (LC-MS) was performed to detect pesticide residues in adult bees, honey, pollen, and corn flowers collected from the studied hives in each location. In addition, general hive conditions were assessed by monitoring colony weight and brood development. Neonicotinoids were only identified in corn flowers at low concentrations. However, honeybee colonies located in neonicotinoid treated cornfields expressed significantly higher pathogen infection than those located in untreated cornfields. AChE levels showed elevated levels among honeybees that collected corn pollen from treated fields. Positive correlations were recorded between pathogens and the treated locations. Our data suggests that neonicotinoids indirectly weaken honeybee health by inducing physiological stress and increasing pathogen loads.

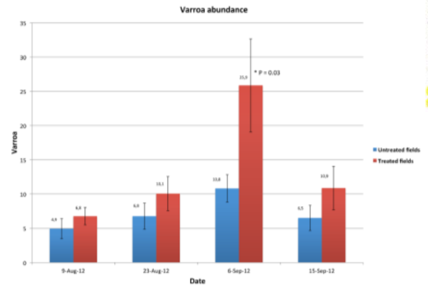
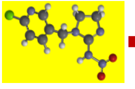


Fig 4. Mean values of varroa mite abundance in the 32 studied colonies, 16 colonies in each treated and untreated cornfields on four different dates. Error bars are the Standard Errors (SE) of each studied group. P values is * P < 0.05.



Imidacloprid

Bee declines driven by combined stress from parasites, pesticides, and lack of flowers

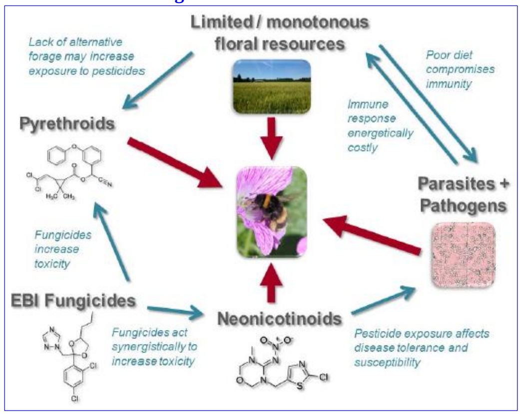
Dave Goulson,* Elizabeth Nicholls, Cristina Botías, Ellen L. Rotheray
School of Life Sciences, University of Sussex, Falmer, Brighton BN1 9QG, UK.
*Corresponding author. E-mail: d.goulson@sussex.ac.uk

www.sciencemag.org on February 26, 2015

Les abeilles font face à des cocktails de pesticides, hors et dans la ruche

Tout aussi vrai pour tous les pollinisateurs sauvages

Agriculture conventionnelle



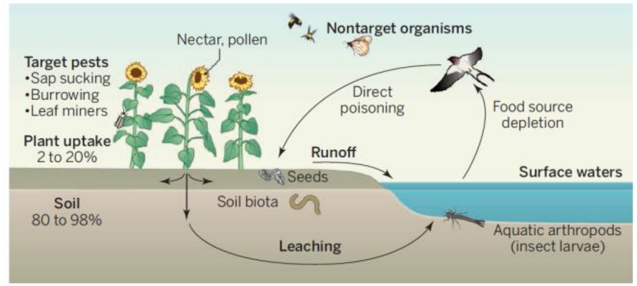
ENVIRONMENTAL SCIENCE

The trouble with neonicotinoids

Chronic exposure to widely used insecticides kills bees and many other invertebrates

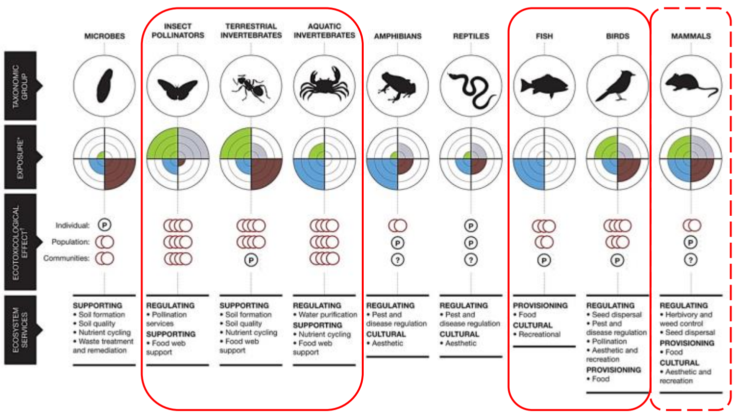
806 14 NOVEMBER 2014 • VOL 346 ISSUE 6211 sciencemag.org SCIENCE

By Francisco Sánchez-Bayo



Fate of neonicotinoids and pathways of environmental contamination.

Worldwide integrated assessment on systemic pesticides & impacts on non-target species



Conclusions of the Worldwide Integrated Assessment on the risks of neonicotinoids and fipronil to biodiversity and ecosystem functioning

- \+ Preventive and massive uses
- \+ Extreme toxicity to invertebrates
- \+ High toxicity to vertebrates
- \+ Very high persistence in soils
- \+ High contamination of surface water

➡

- ➢ General contamination of soils, plants and waters
- ➢ New mechanisms of toxicity (acute and chronic)

- ▶ Extended collapse to all pollinators
- ▶ Extended impacts to soil organisms
- ▶ Extended impacts to aquatic invertebrates

- Not useful in the vast majority of cases
- Increase pest resistance
- Efficient alternative practices
- Less benefits for farmers

- ⏩ Larger impacts on ecosystems
- ⏩ Global threats on ecosystem services
- ⏩ Threats on food production & food security
- ⏩ Threats on human health

⬇

The present use of neonicotinoids is not sustainable
=> Reduce/ban => Integrated pest management (IPM), organic farming…

(252 pages)

anses
agence nationale de sécurité sanitaire alimentation, environnement, travail
Connaître, évaluer, protéger

Co-exposition des abeilles aux facteurs de stress

Avis de l'Anses
Rapport d'expertise collective

Juillet 2015 Édition scientifique

Proposition de réglementation:
==> tests obligatoires :

- *e.g.* insecticide + anti *varroa*
- *e.g.* insecticide + fongicide
- *e.g.* insecticide + insecticide

Puis test en labo & surveillance épidémiologique
- *e.g.* insecticide + virus
- *e.g.* insecticide + *nosema spp*
- *e.g.* insecticide + *varroa spp*

Conclusions (extrait)

Devant le constat de la multiplicité et de l'ampleur de l'exposition aux substances chimiques utilisées en santé des plantes et des animaux d'élevage, il est impératif d'œuvrer de toutes les manières possibles pour une diminution globale des intrants.

Ecosystem services, agriculture and neonicotinoids

European Academies
easac
Science Advisory Council

Academia Europaea
All European Academies (ALLEA)
The Austrian Academy of Sciences
The Royal Academies for Science and the Arts of Belgium
The Bulgarian Academy of Sciences
The Croatian Academy of Sciences and Arts
The Czech Academy of Sciences
The Royal Danish Academy of Sciences and Letters
The Estonian Academy of Sciences
The Council of Finnish Academies
The Académie des sciences (France)
The German National Academy of Sciences Leopoldina
The Academy of Athens
The Hungarian Academy of Sciences
The Royal Irish Academy
The Accademia Nazionale dei Lincei (Italy)
The Latvian Academy of Sciences
The Lithuanian Academy of Sciences
The Royal Netherlands Academy of Arts and Sciences
The Polish Academy of Sciences
The Academy of Sciences of Lisbon
The Romanian Academy
The Slovak Academy of Sciences
The Slovenian Academy of Arts and Science
The Spanish Royal Academy of Sciences
The Royal Swedish Academy of Sciences
The Royal Society (United Kingdom)

The Norwegian Academy of Science and Letters
The Swiss Academies of Arts and Sciences

Critical to assessing the effects of neonicotinoids on ecosystem services is their impact on non-target organisms: both invertebrates and vertebrates, and whether located in the field or margins, or in soils or the aquatic environment. Here, the Expert Group finds the following.

1. There is an increasing body of evidence that the widespread prophylactic use of neonicotinoids has severe negative effects on non-target organisms that provide ecosystem services including pollination and natural pest control.
2. There is clear scientific evidence for sublethal effects of very low levels of neonicotinoids over extended periods on non-target beneficial organisms. These should be addressed in EU approval procedures.
3. Current practice of prophylactic usage of neonicotinoids is inconsistent with the basic principles of integrated pest management as expressed in the EU's Sustainable Pesticides Directive.
4. Widespread use of neonicotinoids (as well as other pesticides) constrains the potential for restoring biodiversity in farmland under the EU's Agri-environment Regulation.

With or without néonics…?

EPA United States Environmental Protection Agency

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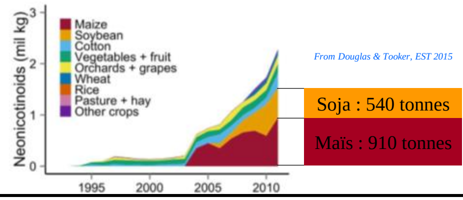
- — Best Management Practices

You are here: EPA Home » Pollinator Protection » Benefits of Neonicotinoid Seed Treatments to Soybean Production

Benefits of Neonicotinoid Seed Treatments to Soybean Production

EPA analyzed the use of the neonicotinoid seed treatments for insect control in United States soybean production. This report provides the analysis and EPA's conclusions based on the analysis. It discusses how the treatments are used, available alternatives, and costs.

EPA concludes that these seed treatments provide little or no overall benefits to soybean production in most situations. Published data indicate that in most cases there is no difference in soybean yield when soybean seed was treated with neonicotinoids versus not receiving any insect control treatment.



From Douglas & Tooker, EST 2015

Cultures biologiques en bandes étroites sur billons

Jean Quentin, MAPAQ, Québec, Canada

https://www.youtube.com/watch?v=gg0VszzY8rM

- Alternance soja, blé & maïs
- bandes sur 3 rangs (90 pouces)
- intercalaire de trèfle rouge (post blé)

- Engrais (granules de fientes de poules x2)
- **aucun pesticide**
- Permutation annuelle des cultures

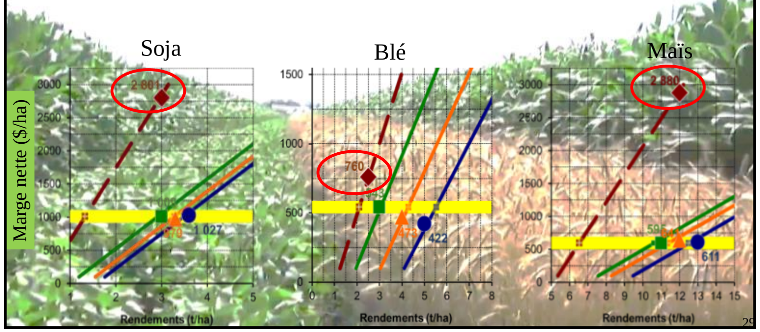


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Table 4: Summary of the main alternative methods in contrast with extensive-, conventional- and intensive agriculture.

These method are generally used in combination (without or) with low-risk pesticides for organic farming and IPM practices. These methods contrast with the prophylactic uses of highly toxic pesticides such as neonicotinoids and fipronil. Table adapted from Bonmatin JM (2016).

Landscape	Farming methods	Organisms	Others
Patchy Edge shrubs Edge crops Bund with flowers Wet zones (e.g. pond) Ecological corridors Trees (agroforestry)	Mutual funds (insurance cover) Crop rotation Resistant variety: . to insects . to diseases Late sowing Mixing varieties Tillage Intercropping Netting Stale seed bed Removal of plants bearing pest Manual pruning Soil cover (e.g. grass)	Macro-organisms: . Parasitoids . Predators: . Vertebrates . Invertebrates Micro-organisms . Fungi . Bacteria	Traps Attractants (traps) Pheromones (traps) Repellants Basic substances . Sugars . Oils . Nettle extracts Mineral barrier (powders) Hot water (plant nursery) Sex confusion Chemical mediators Plant defense stimulators Acoustic confusion Natural-derived insecticides

Large-scale examples

Italy (corn)	=>	same yields & higher profits for farmers
Asia (rice)	=>	higher yields & higher profits
Canada (soybean, wheat & corn)	=>	same yields & higher profits

Dr. JM Bonmatin (CNRS) France

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Maïs : lute intégrée et assurance mutelle.

Dr L. Furlan, Veneto Agricultura, Italy

http://www.reterurale.it/apenet & http://www.pure-ipm.eu/project

Ravageurs : Noctuelles et chrysomèles

(Agrotis species) *(Diabrotica species)*

Néonicotinoïdes: Interdits en 2008

Etude comparative (30 ans)

==> **Risques de dommages économiques < 4%**

Stratégie	Insecticide	Coût total (dommages inclus)	2009/128/CE
Néonicotinoïdes	oui	40 €/ha	☠
Lutte intégrée	oui	14 €/ha	☺
Assurance mutuelle	non	25 €/ha	☺

Résultats 2015: 53,000 ha assurés
Cotisation : 3,5 €/ha

Indemnisation:
- noctuelles
- chrysomèles
- ravageurs
- faune sauvage
- météo,
- autres

Reste pour l'année suivante : 105.000 €

Dr. JM Bonmatin (CNRS) France

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anses

Connaître, évaluer, protéger

Avis de l'Anses
Saisine n° 2016-SA-0057

Le Directeur général

Maisons-Alfort, le

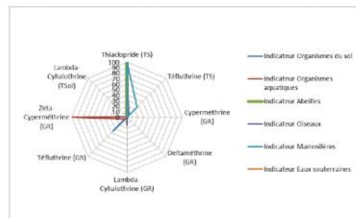
AVIS
de l'Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail

relatif à « l'Evaluation mettant en balance les risques et les bénéfices relatifs d'autres produits phytopharmaceutiques autorisés ou des méthodes non chimiques de prévention ou de lutte pour les usages autorisés en France des produits phytopharmaceutiques comportant des néonicotinoïdes »
-
Avis intermédiaire

- Concernant l'usage Maïs*Trt Sem*Mouches

Aucune alternative au thiaclopride n'a été identifiée.

Figure 28 : Indicateurs de risque l'environnement des substances actives contenues dans des préparations disposant d'une AMM pour la lutte contre les ravageurs du sol sur le mais



- Concernant l'usage Maïs*Trt Sem*Ravageurs du sol

Les alternatives identifiées sont des méthodes agronomiques limitant les populations de taupins et de chrysomèles et favorisant la vigueur de la plante ainsi que les autres préparations phytopharmaceutiques ayant une AMM pour cet usage.

Parmi les substances actives autorisées sur cet usage, le thiaclopride est généralement associé à un indicateur de risque moins élevé pour la santé humaine (risque alimentaire et non alimentaire) que les pyréthrinoïdes.

Il convient toutefois de rappeler que, dans son avis en réponse à la saisine 2016-SA-0104, portant sur les impacts des néonicotinoïdes sur la santé humaine, l'Anses a souhaité souligner le fait que les propriétés de danger du thiaclopride ainsi que l'accroissement important de son utilisation au cours des dernières années justifient qu'une attention particulière soit portée aux usages de cette substance.

Concernant les risques pour l'environnement, le thiaclopride a des indicateurs de risque supérieurs à ceux des alternatives pour les oiseaux, les mammifères, les vers de terre et les abeilles, moins élevé pour les organismes aquatiques et du même ordre pour les eaux souterraines.

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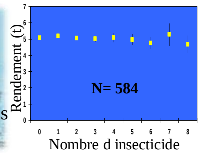
Riz : études multi-pays & pluriannuelles

Pr K.L. Heong, Zhejiang University, Hangzhou, China

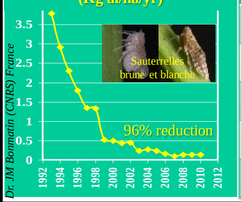
Vietnam



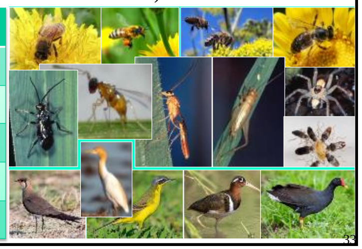
Philippines

Philippines	Strategies	Nbr de sprays	Rendement
Laguna	Contrôle	0	-
	Lutte intégrée	1	- 5.0%
	Stratégie locale	2	- 3.6%
	Conventionnel	6	- 11.7%

Chine: reduction de 96% des insecticides (pas de néonicotinoïdes) et bordures florales



Biodiversité (S_r)	1989	2005
Herbivores	13.6	36
Prédateurs	37.6	65
Parasitoïdes	17.1	38
Detritivores	5.6	30
Tous arthropodes	75	169



Take home message: 6th mass extinction of vertebrates
& mass extinction of invertebrates

PNAS

Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines

The population extinction pulse we describe here shows, from a quantitative viewpoint, that Earth's sixth mass extinction is more severe than perceived when looking exclusively at species extinctions. Therefore, humanity needs to address anthropogenic population extirpation and decimation immediately. That conclusion is based on analyses of the numbers and degrees of range contraction (indicative of population shrinkage and/or population extinctions according to the International Union for Conservation of Nature) using a sample of 27,600 vertebrate species, and on a more detailed analysis documenting the population extinctions between 1900 and 2015 in 177 mammal species. We find that the rate of population loss in terrestrial vertebrates is extremely high—even in "species of low concern." In our sample, comprising nearly half of known vertebrate species, 32% (8,851/27,600) are decreasing; that is, they have decreased in population size and range. In the 177 mammals for which we have detailed data, all have lost 30% or more of their geographic ranges and more than 40% of the species have experienced severe population declines (>80% range shrinkage). Our data indicate that beyond global species extinctions Earth is experiencing a huge episode of population declines and extirpations, which will have negative cascading consequences on ecosystem functioning and services vital to sustaining civilization. We describe this as a "biological annihilation" to highlight the current magnitude of Earth's ongoing sixth major extinction event.

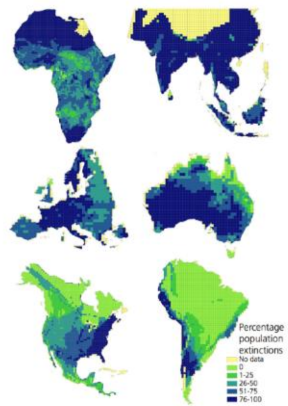


Fig. 6. Percentage of local population extinction in 177 species of mammals in 1° × 1° quadrats, as an indication of the severity of the mass extinction crises. The maps were generated by comparing historic and current geographic ranges (49) (*SI Appendix, SI Methods*). Note that large regions in all continents have lost 50% or more of the populations of the evaluated mammals. Because of the small sample size, biased to large mammal species, this figure can only be used to visualize likely trends in population losses.

WHERE HAVE ALL THE INSECTS GONE?

Surveys in German nature reserves point to a dramatic decline in insect biomass. Key members of ecosystems may be slipping away

By **Gretchen Vogel**, *in Krefeld, Germany*

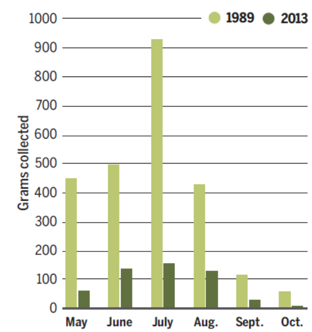
sciencemag.org **SCIENCE**

12 MAY 2017 • VOL 356 ISSUE 6338

Neonicotinoid pesticides, already implicated in the widespread crash of bee populations, are another prime suspect.

Weighty disappearances

The mass of insects collected by monitoring traps in the Orbroicher Bruch nature reserve in northwest Germany dropped by 78% in 24 years.



And public health…

Dr. JM Bonmatin (CNRS) France 37

Exposure (intake by food)

JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY

Article
pubs.acs.org/JAFC
Open Access on 06/16/2015

Quantitative Analysis of Neonicotinoid Insecticide Residues in Foods: Implication for Dietary Exposures

Mei Chen,[†] Lin Tao,[†] John McLean,[§] and Chensheng Lu[*,†]

USA 2015:
100% fruits & vegetable samples contained at least 1 neonicotinoid
72% of fruits contained at least 2 neonicotinoids
45% of vegetables contained at least 2 neonicotinoids

Exposure (detoxication by urine)

Advance Publication

Journal of Occupational Health

Accepted for Publication: Aug 7, 2014

Title: Biological Monitoring Method for Urinary Neonicotinoid Insecticides Using LC-MS/MS and Its Application to Japanese Adults

Running title: *Biological monitoring of neonicotinoids in Japanese adults*

Jun Ueyama[a,*], Hiroshi Nomura[a], Takaaki Kondo[a], Isao Saito[b], Yuki Ito[c] Aya Osaka[a] and Michihiro Kamijima[c]

Japan 2014:
90 % of individuals were positive for at least 4 neonicotinoi[ds]
(imidacloprid, clothianidin, dinotefuran & thiacloprid)

Public health (effects)

- **2007: Potential endocrine disruptors**
- **2012-2014: 2012-2014: Genotoxic and cytotoxic**
- **2012: Linked to the autistic spectrum**
- **2013 (ANSES): Carcinogen**
- **2013 (EFSA): Neuro-developmental effects**
- **2014: Hepatic effects**
- **2014: Effects on thyroid & testicles**
- **2014: Synergies with other pesticides**
- **2014 (Japan): sub-acute effects on poisoned people (hospital)**
- **2015-2017: The list of diseases increases year after year…**

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Environmental and Occupational Health Faculty Publications — Environmental and Occupational Health

APA Citation
Cimino, A., Boyles, A., Thayer, K., & Perry, M. J. (2016). Effects of Neonicotinoid Pesticide Exposure on Human Health: A Systematic Review. *Environmental Health Perspectives*, (). http://dx.doi.org/10.1289/EHP515

7-6-2016

Effects of Neonicotinoid Pesticide Exposure on Human Health: A Systematic Review.

Andria M Cimino
Abee L Boyles
Kristina A Thayer
Melissa J. Perry
George Washington University

Results: Eight studies investigating the human health effects of exposure to neonics were identified. Four examined acute exposure: three neonic poisoning studies reported two fatalities (n=1280 cases) and an occupational exposure study of 19 forestry workers reported no adverse effects. Four general population studies reported associations between chronic neonic exposure and adverse developmental or neurological outcomes, including tetralogy of Fallot (AOR 2.4, 95% CI: 1.1-5.4), anencephaly (AOR 2.9, 95% CI: 1.0-8.2), autism spectrum disorder (AOR 1.3, 95% CrI: 0.78-2.2), and a symptom cluster including memory loss and finger tremor (OR 14, 95% CI: 3.5-57). Reported odds ratios were based on exposed compared to unexposed groups.

Dr. JM Bonmatin (CNRS) France 39

Toxicology and Applied Pharmacology 332 (2017) 15–24

The use of a unique co-culture model of fetoplacental steroidogenesis as a screening tool for endocrine disruptors: The effects of neonicotinoids on aromatase activity and hormone production

Elyse Caron-Beaudoin[a,c,*], Rachel Viau[a], Andrée-Anne Hudon-Thibeault[a,b,c], Cathy Vaillancourt[a,b,c], J. Thomas Sanderson[a]

[a] *INRS - Institut Armand-Frappier, Laval, QC H7V 1B7, Canada*
[b] *BioMed Research Center, Université du Québec à Montréal, Montreal, QC H3C 3P8, Canada*
[c] *Center for Interdisciplinary Research on Well-Being, Health, Society and Environment (CINBIOSE), Université du Québec à Montréal, Montreal, QC H3C 3P8, Canada*

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Aromatase
Nonicotinoids
Co-culture
Estriol

ABSTRACT

Estrogen biosynthesis during pregnancy is dependent on the collaboration between the fetus producing the androgen precursors, and the placenta expressing the enzyme aromatase (*CYP19*). Disruption of estrogen production by contaminants may result in serious pregnancy outcomes. We used our recently developed *in vitro* co-culture model of fetoplacental steroidogenesis to screen the effects of three neonicotinoid insecticides on the catalytic activity of aromatase and the production of steroid hormones. A co-culture of H295R human adrenocortical carcinoma cells with fetal characteristics and BeWo human choriocarcinoma cells which display characteristics of the villous cytotrophoblast was exposed for 24 h to various concentrations of three neonicotinoids: thiacloprid, thiamethoxam and imidacloprid. Aromatase catalytic activity was determined in both cell lines using the tritiated water-release assay. Hormone production was measured by *ELISA*. The three neonicotinoids induced aromatase activity in our fetoplacental co-culture and concordingly, estradiol and estrone production were increased. In contrast, estriol production was strongly inhibited by the neonicotinoids. All three pesticides induced the expression of *CYP3A7* in H295R cells, and this induction was reversed by co-treatment of H295R cells with exogenous estriol. *CYP3A7* is normally expressed in fetal liver and is a key enzyme involved in estriol synthesis. We suggest that neonicotinoids are metabolized by *CYP3A7*, thus impeding the 16α-hydroxylation of fetal DHEA(-sulfate), which is normally converted to estriol by placental aromatase. We successfully used the fetoplacental co-culture as a physiologically relevant tool to highlight the potential effects of neonicotinoids on estrogen production, aromatase activity and *CYP3A7* expression during pregnancy.

Dr. JM Bonmatin (CNRS) France 40

Au nom de la loi…

ASSEMBLÉE NATIONALE

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ART. 51 QUATERDECIES N°452

ASSEMBLÉE NATIONALE
22 juin 2016

ADOPTÉ

AMENDEMENT N°452

ARTICLE 51 QUATERDECIES

Rédiger ainsi cet article :

« I. – L'article L. 253-8 du code rural et de la pêche maritime est ainsi modifié :

« 1° Au début du premier alinéa, est ajoutée la référence : « I » ;

« 2° Il est ajouté un II ainsi rédigé :

« II. – L'utilisation de produits phytopharmaceutiques contenant une ou des substances actives de la famille des néonicotinoïdes et de semences traitées avec ces produits est interdite à compter du 1er septembre 2018.

« Des dérogations à l'interdiction mentionnée au premier alinéa du présent II peuvent être accordées jusqu'au 1er juillet 2020 par arrêté conjoint des ministres chargés de l'agriculture, de l'environnement et de la santé.

« L'arrêté mentionné au deuxième alinéa du présent II est pris sur la base d'un bilan établi par l'Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail qui compare les bénéfices et les risques liés aux usages des produits phytopharmaceutiques contenant des substances actives de la famille des néonicotinoïdes autorisés en France avec ceux liés aux usages de produits de substitution ou aux méthodes alternatives disponibles.

« Ce bilan porte sur les impacts sur l'environnement, notamment sur les pollinisateurs, sur la santé publique et sur l'activité agricole. Il est rendu public dans les conditions prévues par le dernier alinéa de l'article L. 1313-3 du code de la santé publique. »

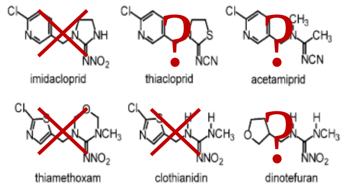
« II. – Le dernier alinéa du II de l'article L. 254-7 du code rural et de la pêche maritime, dans sa rédaction résultant de la loi n° 2015-992 du 17 août 2015 relative à la transition énergétique pour la croissance verte est ainsi modifié :

« 1° Les mots : « et des » sont remplacés par le signe : « , » ;

« 2° Après la seconde occurrence du mot : « Conseil » sont insérés les mots : « et des produits dont l'usage est autorisé dans le cadre de l'agriculture biologique »

http://www.assemblee-nationale.fr/14/amendements/3833/AN/452.asp

➢**EFSA: Réévaluation de 2013 & réévaluations de 2018**



L 139/12 EN Official Journal of the European Union 25.5.2013

COMMISSION IMPLEMENTING REGULATION (EU) No 485/2013

of 24 May 2013

amending Implementing Regulation (EU) No 540/2011, as regards the conditions of approval of the active substances clothianidin, thiamethoxam and imidacloprid, and prohibiting the use and sale of seeds treated with plant protection products containing those active substances

(Text with EEA relevance)

2013-2015 : Pas de réduction significative des rendements agricoles en Europe

➢**France :** **Interdiction partielle (1999, 2004, 2010, 2013) & interdiction totale en 2018**
➢**Italie :** **Interdiction locale (2008) et moratoire UE (2013)**
➢**Allemagne :** **Moratoire UE (2013) & interdiction additionnelle (2015)**

➢**Philippines :** **Interdiction locale (2014)**
➢**Japon :** **Interdiction partielle (2015)**

➢**Canada :** **Interdiction à Montréal (2014), Toronto (2015), Vancouver (2016)…**
+ 80% de réduction en Ontario (2017), nouvelle décision en cours au Québec (imidaclopride)
➢**USA :** **Interdiction locale (Maryland, 2016)**
+ Moratoire sur les nouvelles molécules & réévaluation complète (2018)

Journal of Alzheimer's Disease xx (20xx) x–xx
DOI 10.3233/JAD-170875
IOS Press

Induction of Amyloid-β_{42} Production by Fipronil and Other Pyrazole Insecticides

Morgane Cam[a,1], Emilie Durieu[a,1], Marion Bodin[a], Antigoni Manousopoulou[b], Svenja Koslowski[a,c], Natalia Vasylieva[d], Bogdan Barnych[d], Bruce D. Hammock[d], Bettina Bohl[e], Philipp Koch[e,f], Chiori Omori[g,h], Kazuo Yamamoto[h], Saori Hata[g], Toshiharu Suzuki[g], Frank Karg[i], Patrick Gizzi[j], Vesna Erakovic Haber[k], Vlatka Bencetic Mihaljevic[k], Branka Tavcar[k], Erik Portelius[l], Josef Pannee[l,m], Kaj Blennow[l,m], Henrik Zetterberg[l,m,n,o], Spiros D. Garbis[b], Pierrick Auvray[c], Hermeto Gerber[p,q,r], Jeremy Fraering[p,q], Patrick C. Fraering[p,q] and Laurent Meijer[a,*]

Accepted 8 January 2018

Abstract. Generation of amyloid-β peptides (Aβs) by proteolytic cleavage of the amyloid-β protein precursor (AβPP), especially increased production of $A\beta_{42}/A\beta_{43}$ over $A\beta_{40}$, and their aggregation as oligomers and plaques, represent a charac-
$A\beta_{42}/A\beta_{43}$ over $A\beta_{40}$ and shorter Aβs. To detect such products, we screened a library of 3500 + compounds in a cell-based assay for enhanced $A\beta_{42}/A\beta_{43}$ production. Nine pyrazole insecticides were found to induce a β- and γ-secretase-dependent, 3-10-fold increase in the production of extracellular $A\beta_{42}$ in various cell lines and neurons differentiated from induced pluripotent stem cells derived from healthy and FAD patients. Immunoprecipitation/mass spectrometry analyses showed increased production of Aβs cleaved at positions 42/43, and reduced production of peptides cleaved at positions 38 and shorter. Strongly supporting a direct effect on γ-secretase activity, pyrazoles shifted the cleavage pattern of another γ-secretase substrate, alcadeinα, and shifted the cleavage of AβPP by highly purified γ-secretase toward $A\beta_{42}/A\beta_{43}$. Focusing on fipronil, we showed that some of its metabolites, in particular the persistent fipronil sulfone, also favor the production of $A\beta_{42}/A\beta_{43}$ in both cell-based and cell-free systems. Fipronil administered orally to mice and rats is known to be metabolized rapidly, mostly to fipronil sulfone, which stably accumulates in adipose tissue and brain. In conclusion, several widely used pyrazole insecticides enhance the production of toxic, aggregation prone $A\beta_{42}/A\beta_{43}$ peptides, suggesting the possible existence of environmental "Alzheimerogens" which may contribute to the initiation and propagation of the amyloidogenic process in sporadic AD.

Dr. JM Bonmatin (CNRS) France