Special workshop on Neonicotinoids and their Impact on Ecosystem Services for Agriculture/Biodiversity in Africa

Armand PARAÏSO

Université de Parakou, Faculté d' Agronomie

Laboratory of Plant Protection, Bee's Pathology and Parasitology
http://www.lappab.com
BP : 123 Parakou, République du Bénin

E-mail : arparaiso@yahoo.fr
armand.paraiso@fa_up.bj

Thanks to

- **Academy of Science of South Africa (ASSA) and**
- **Academy of Science Leopoldina**
- **Other organizators**

For

- **Scientific thinking in the Service of Society**

Neonicotinoids insecticids in Benin

UNIVERSITE DE PARAKOU

DOCTRINA LUMEN HUMANI GENERIS EST

UP

Laboratoire de parasitologie et de pathologie des abeilles - Bénin - Protection des Végétaux

Imidaclopride, Acetamipride, Thiaclopride, **Sulfoxaflor**

Outline

- Introduction
- Material and methods
- Resultats and Discussions
- Conclusion
- Suggestions

Introduction

- In Benin, Agriculture employs almost 80% of the labour force, contributing almost 70% to export earnings and 40% to gross National product (GNP).

- Several speculations are cultivated, including :
- cotton,
- fruit crops,
- vegetable crops and other crops

Introduction

- Protection of these crops, in particular cotton, is based essentially on the use of chemical pesticides ;
-
- Producers, often spray crops with a variety of pesticides at inappropriate doses.
-
- **The mean doses applied** to vegetable and cotton cultures are between **1.5 and 5 times higher** than the recommended doses.

Introduction

- what can be the consequences of such practices on humans, environment and biodiversity ?
-
- What are the possible impacts of pesticides used in agriculture on bees and the environment?
-
- This study will strive to address the Bee situation in Benin.

Bees

- Bees are species whose economic, health and agronomic importance is considerable.

- Honey bees (*Apis mellifera* L.) play an important role in maintaining ecological equilibrium and conserving biodiversity

-

Bees in Benin

- Benin has very important apicultural potential and rich repertoire of pollinating insects.

- Since ten years, it is observed :

- a drastic decrease in the population of bees ;
- a serious reduction in their activity ;
- a sudden disappearance of the colonies or a massive mortality of the bees
- ¶

Bees in Benin

- Among these multiple reasons, we can be quoted :

- The destruction of the melliferous flora ;
- the presence of parasites, predators and bee’s diseases,
- the exposure of the bees to various types of chemical insecticides used in crop protection, specially neonicotinoid insecticides.

Objective

To draw attention on the eco-toxicological risks of pesticides, specially the neonicotinoïds insecticids on bees *Apis mellifera* adansonii in Benin, .

Materials and methods

Tropilaelaps clarae

- The study was carried out at the laboratory of Plant Protection, Bees Pathology and Parasitology (LAPPAB) of the Faculty of Agronomy of the University of Parakou. http://www.lappab.com
-

Biological material

Bees: *Apis mellifera* adansonii

Materials and methods

- Bees were taken from the hives and transported to laboratory. Active ingredent and different doses insecticides used were as followed :

Material and methods

- Ema 19.2 EC (19,2g/L of emamectine benzoate)
- Thunder 145 O-TEQ (45g/L betacyfluthrine and 100g/L of l'imidaclopride)
- Lamdex 30 + Chlorpyrifos 400.
- Master 25 EC (25g/L of Lambda cyhalothrine)
- Pacha 25 EC (10g/L of acetamitride and 15g/L of lambda cyhalothrine)
- Décis 12.5 EC (25g/L of deltametrine)

Material and methods

- The eco-toxicological risk of pesticides to bees was evaluated by topical application test with the six (06) Insecticides, at doses ranging from 50 ppm to 5000 ppm for each of them.
- Each treatment consisted of three (3) replicated of 25 bees and consisted of applying to the pronotum of the bees previously anesthetized with ether, **one microliter (01µl) of each dose**.
- Observations were made at 2, 10, 24 and 48 hours after the application.

Material and methods

- For each of these insecticides, formulations of **5000ppm; 3000ppm; 2000ppm; 1000ppm; 500ppm; 250ppm; 100ppm and 50ppm** were prepared and corresponding to the doses per bee in a 1 microliter:

- 96.0 ng/µl/b (**96.0ng/µl/bee**); 57.6 ng/µl/b; 38.4 ng/µl/b; 19.6 ng/µl/b; 9.6 ng/µl/b; 4.8 ng/µl/b; 1.92 ng/µl/b and **0.96 ng/µl/b**, for EMA 19.2 EC;

Material and methods

- **725 ng/µl/b**; 435 ng/µl/b; 290; 145 ng/µl/b; 72.5 ng/µl/b; 36.25 ng/µl/b; 14.5 ng/µl/b; **7.25 ng/µl/b** for Thunder 145 O-TEQ;
- **2150 ng/µl/b**; 1290 ng/µl/b; 860 ng/µl/b; 430 ng/µl/b; 215 ng/µl/b; 107.5 ng/µl/b; 43 ng/µl/b and **21.5 ng/µl/b** for the insecticide containing Lamdex 30 + Chlorpyrifox 400;

- Control, where the bees were inoculated with water without insecticide.

Results

- What results was obtained ?
- The effect of increasing doses of active ingredients of Thunder (145 O-TEQ (45g.L^{-1} betacyfluthrine and 100g.L^{-1} of l'imidaclopride) showed that :
  - the highest dose 725 ng/ µl/bee has shown higher mortality than all other doses 24 hours (69.3±1.3 a ; 92.0±2.3 a ; 100.0±0.0 a ; 100.0±0.0 a) while,
- The second neonicotinoïd showed similar response.
  - Pacha 25 EC (10g.L^{-1} of acetamitride and 15g.L^{-1} of lambda ; 125 ng/ µl /bee (50.6±5.8 ; 68.0±0.0 a; 94.6±3.5 a and 98.6±1.3 a for 48 hrs.

What happpened with the lowest doses?

Tabl : Mortality rates induiced by the lowest doses insecticides used on bees

Insecticides	Lowest doses ng/µl/bee				
		2 hours	10 hours	24 hours	48 hours
Emamectine	0.96	10.7±2.7 a	36.0±0.0 ab	74.7±1.3 ab	90.7±1.3bc
Thunder	7.25	17.3±1.3bc	65.0±5.8 d	94.0±2.6 a	98.6±1.3 a
Lamdex	21.5	17.3±3.5 c	70.6±3.5c	88.0±4.0 a	96.4±4.0a

Tabl : Mortality rates induiced by the lowest doses insecticides used on bees

Insecticides	Lowest doses ng/µl/bee				
		2 hours	10 hours	24 hours	48 hours
Master	1.25	6.6±2.6 d	37.3±8.1 b	65.3±6.6 c	88.0±10.6a
Pacha	1.25	36.0±6.9	61.3±5.8 a	77.3±6.6 ba	93.3±4.8 a
Decis	1.25	14.7±3.5 bc	34.7±4.8 bc	44.0±6.1 b	68.0±6.1 b

Results

- **The application on bee of the association** of Betacyfluthrin (45g/l), which is a pyrethroid and Imidacloprid (100g/l), a neonicotinoid indicated values of LD50 varying from:
- **19.9 ng/bee for 10 hours exposure to 1.1 10^{-2}ng/b for 18 hours** and,
- 5. 10^{-4} ng/b for 36 hours**.**
- **With the association** (10g/L of acetamitride and 15g/L of lambda cyhalothrine) The values of LD 50 obtained ranged **from** 1.66 10^{-2} ng/ab for 10 **hours of exposure to** 9.96 10^{-2} ng/ab pour 24 **exposure**.

Acarapis woodi

Discussions

Apocephalus borealis

- **The results of this study have shown the impact on bees of nicotinoïds insecticides and others commonly used in agriculture in Benin.**
- **Used to control pests, these insecticides showed their toxicity to the major pollinators, *Apis mellifera* adansonii, which is quite worrying.**

- **To the best of our knowledge, very few studies on the toxicity of pesticides with regard to bees have been carried out in Sub-Saharan Africa, in particular.**

Discussions

- **These studies are all the more important that, insecticides used in agriculture are destroying millions bees colonies and thousands of beekeepers in :**
- **US,**
- **Europe:**
- **Asia and,**
- **even in Africa, are giving up, because there is not enoughpositive response by the scientist and the Society to their serious problems, (Bad chemical pesticides practices, bees collapse, parasites, predators, bee diseases etc…).**

Discussions

- Data in the study showed that even the lowest doses caused high bee mortality rates.
- **The present works also addressed** the issue of toxicity of Thunder, an insecticide with active ingredients including Betacyfluthrin (45g/l), a synthesis pyrethroid **and Imidacloprid (100g/l)**, a neonicotinoid insecticide actually forbidden in some European countries, but abundantly used in many countries in Africa.

- Results with Thunder (145 O-TEQ (45g/L betacyfluthrine and 100g/L of l'imidaclopride) indicated an LD50 varying from 19. 9ng/bee for 10 hours exposure to 1.1. 10^{-2}ng/bee for 24 hours and 5. 10^{-4}ng/bee for 48hrs.

Discussions

- Results tally with those of Suchail et *al*, (2000), who obtained **for the LD50 at 24 and 48 h, 24 ng/b per topical application of imidacloprid** on *Apis mellifera* mellifera.

- The same authors show the values of **14 µg/b for *Apis mellifera* caucasica per topical application**.
- **A LD50 varying from 49 at 102 ng/b at 48 h per topical application is obtained** (Nauen et *al*, 2001).

CONCLUSION

- In the face of all the aforementioned, reasoned control (rational utilization of chemical pesticides) of crop pests is one of the factors that condition the success of plant protection and the conservation of our environment and Biodiversity

- However, there are many other consequences of this bad agricultural practice in crop protection. A few of them are:
  - Change in behavioral attitudes and aptitudes of the bees,
  - Toxicity of beehive products,
  - Increased sensitivity of the bees to the different attacks of parasites and diseases,
    - **all this leading to desertion of the beehives and the disappearance of several hundreds of swarms of bees, a phenomenon already observed by beekeepers in Benin.**

CONCLUSION

- These studies have shown the urgency of the integrated protection aspect of bees in all protection strategies of our crops in order to associate the promotion of good agricultural practices in crop protection.
- The neonicotinoids insecticides tested are among the most used **in cotton, market gardening and arboriculture protection**.
- These crops depend on, at least 90% or more, bees' pollination and other pollinators for their yield.
- Non-judicious choice, as well as bad practices in plant protection is a real handicap to achieving the objectives of modern agriculture which aim at increasing yields and food security.

CONCLUSION AND SUGGESTIONS

- A **severe codification** of the use of most insecticides studied should safeguard crop auxiliaries by increasing considerably yields.

- Promotion of strategies as part of the dissemination of good agricultural practices in plant protection is a guarantee which should ensure sustainable agriculture and environmental, human and biodiversity protection in our countries and in the world for the better of the future generation.

CONCLUSION ET SUGGESTIONS

- Our peasants and the whole environment are exposed to the serious consequences of a slow and sure widespread pollution.

Conservative measures must be taken to avoid the total decline in short and medium term of biodiversity in our respective countries, for the happiness of future generations to whom we owe the present Environnement and Biodiversity.

Thanks

"If the bees were to disappear, mankind would only have four years before it..." » Albert Einstein