

The acute oral toxicity of insecticides used in plant protection: Thiamethoxam (Actara 25WG) on honeybee *Apis mellifera intermissa*

CHAHBAR N. *, BELZUNCES L. P.** & DOUMANDJI S. * * *

*Department of Biology, Faculty of Science, University M'hamed Bougara Boumerdes

** Environmental Toxicology Laboratory UMR 406 Invertebrate Ecology INRA avignon

** Department of Agricultural and Forest Zoology, Ecole Nationale Supérieure Agronomique El-Harrach- Algiers

INTRODUCTION

In recent years, we observed worsening symptoms of poisoning in bees in Algeria. Indeed, many beekeepers reported a weakening or even total depopulation of the colony. This could have an origin linked to dysfunction of the nervous system of bees because 90% of insecticides used in the field have neurotoxic properties.

The commercial specialty of Actara WG 25% of the active ingredient thiamethoxam is recognized as being toxic to bees and it is forbidden to use during the flowering period. However, the Thiamethoxam is systemic, it is present in low concentrations in the treated plants throughout its development cycle. What are the effects induced in the bee by contamination by low doses of Thiamethoxam which could be contained in the pollen and nectar when flowering?

To answer this problem, we first determine the sensitivity of the honeybee *Apis mellifera intermissa* by testing the acute oral toxicity of thiamethoxam, which provides guidance on the threshold of subletality.

RESULTS & DISCUSSION

Rapid onset of symptoms of neurotoxicity

About 15 to 20 minutes after poisoning, the bees show a general activity rapidly increased with disorderly movements, tremors and convulsions, and apathetic behavior. All these symptoms are reversible after 24 hours

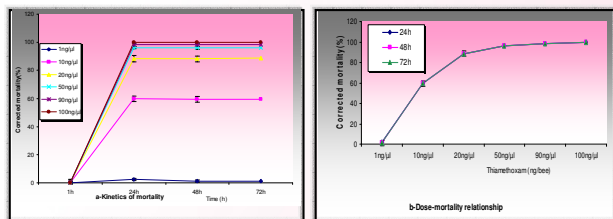


Figure 2: Acute oral toxicity of thiamethoxam in the bee *Apis mellifera intermissa* in spring
a: bee mortality is followed at different times for the doses of thiamethoxam: 1, 10, 20, 50 and 90 ng / μl.
b: Corrected mortality is the mortality of bees poisoned with thiamethoxam corrected by raising the mortality of bees ingested only a sucrose solution. Values represent the mean ± standard error of 3 experiments repeated on three occasions.

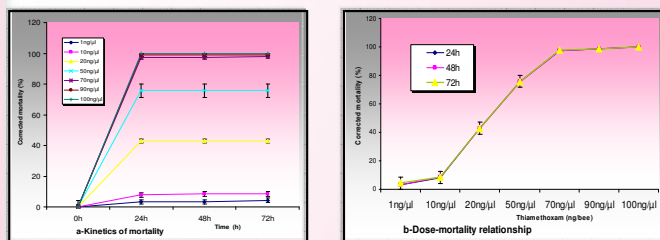


Figure 4: Acute oral toxicity of thiamethoxam in the bee *Apis mellifera intermissa* in summer
a: bee mortality is followed at different times for a given dose of thiamethoxam: 1, 10, 20, 50, 70, 90 and 100 ng / μl.
b: Corrected mortality is the mortality of bees poisoned with Thiamethoxam corrected by raising the mortality of bees ingested only a sucrose solution. Values represent the mean ± standard error of 3 experiments repeated on three occasions.

Conclusion

The deep toxicological study of plant protection products prior to approval and marketing contributes greatly to identify the problems of poisoning in the bees and environmental protection.

The toxicity of thiamethoxam seems extremely high confirming its dangerousness during the spring period.

MATERIAL & METHODS



Figure 1: Crates restraint type bread up in an oven at a toxicology test.

For this work we adopted the method of laboratory CEB No. 95 [1] which allows to assess the acute toxicity of plant protection products in the adult worker honeybee *Apis mellifera* L., by determining the 50% lethal dose (LD50) oral and contact 24, 48 and 72 hours after treatment.

And we tried to determine and compare the LD50 treatment in spring and summer to clarify if there is any difference in sensitivity.

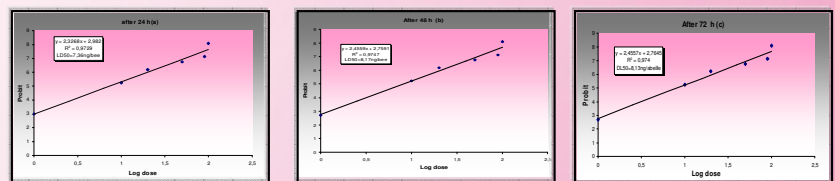


Figure 3: The regression function of thiamethoxam doses respectively after 24h (a), 48h (b) and 72h (c) during spring

These results show that there is a direct proportional relationship between the administered dose of thiamethoxam and mortality observed. In addition, mortality is changing over time, reaching its maximum for each dose after 24 hours which is illustrated by the overlapping curves.

The LD50 obtained in spring were lower than those obtained in summer.

The difference of LD50 obtained in spring and summer due to the low power of detoxification of the bee during the spring period, the enzymatic activity of aldrin epoxidase is decreasing steadily [2].

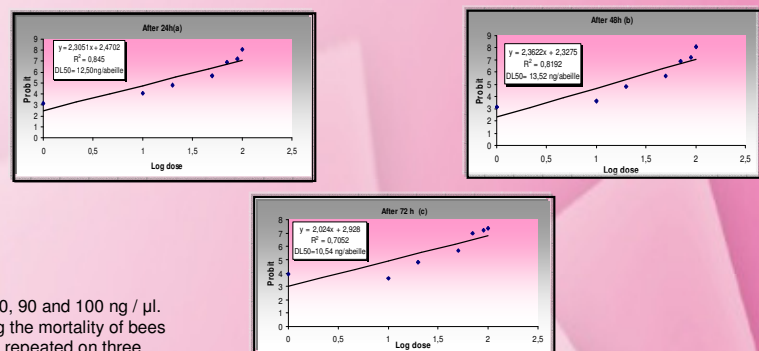


Figure 5: The regression function of thiamethoxam doses respectively after 24h (a), 48h (b) and 72h (c) in summer

References

- [1]CEB, 1995 – Méthode de laboratoire d'évaluation des effets de toxicité aiguë orale et de contact des préparations phytopharmaceutiques chez l'abeille domestique *Apis mellifera* L. *Méthode*, (95) : 1-8.
- [2]Smirle M.J. & Winston M.L., 1987- Intercolonial variation in pesticide detoxification by the honey bee (*Hymenoptera: apidae*). *J. Econ. Entomol.*, 80 : 5-8.