The Degree of Intoxication at Bees with Some Substances from the Pesticides Group

Alin Jivan, Silvia Pătruică, Antonina Jivan

Banat's University of Agricultural Sciences and Veterinary Medicine, 300645 Timisoara, Calea Aradului 119, Romania

Abstract

The purpose of the paper is to prove the impact of the treatment with pesticides, at the entomophilous crops, on their main pollinator, the bees, and also to highlight the protection measures of the man and bee families against intoxications with pesticides. Refers to some commonly used insecticides in agriculture for the control of harmful insects. In order to detect the intoxication degree of bees, samples of honey contaminated with pesticides prepared and administered as food to bees from experiments, were examined using the HPLC (High performance liquid chromatography) chromatograph. The control sample and also the samples contaminated with Decis 2.5 EC, Faster 10 EC, Karate Zeon and Lider 70 WG were analyzed. Some solutions have been prepared with all the commercial products enumerated. The process has been started with the concentration recommended by the producing firm for each product at it was considered that it represents the 1% concentration used in combating pests from agricultural fields, from this percent there was an increase respecting the dilution up to the concentration of 1,25%.

Keywords: bee families, determination, substances.

1. Introduction

The intoxication is a pathological state that installs after a toxic substance enters the organism, an action that causes disturbances, alteration or even abolishing the vital function. The intoxication is an answer from the body to the toxic that is within itself.

Applying insecticide treatments in plantations and cultures, during blooming will be made in such conditions so to fully protect the bees by using some selective products, harmful for these, by announcing the bee keeper ahead on the treatments to be done [1].

The chemical method for combating pests from cultures leads to increasing the number of natural pollenizers of plants and the necessity of protecting and using properly the bees as pollenizing insects, for the purpose of vegetal spreading [2].This thing can be achieved by using some chemical substances which are less toxic for bees and by applying them in moments that don't interfere with bee activity [3].

Insecticides, no matter of their nature, the ingestion, contact or breathing, are harmful when they penetrate the bee's organism and provokes a physiologic unbalance at some fundamental biological processes [4, 5].

2. Materials and methods

The research substances for showing the way in which bees' behaviour is influenced have been: Decis 2,5 EC (deltamethrin 25 g/l); Faster 10 CE (cipermethrin 100 g/l); Karate-zeon (lambda cihalothrin 50 g/l); Lider 70 WG (imidacloprid 70%).

Four wooden boxes have been built and 100 bee individuals have been introduced in each box,

* Corresponding author: Alin Jivan, Email: alin.jivan@yahoo.com

food was distributed equally to all the variants according to the doses of experimented substance. For testing the acute contact toxicity of some pesticides at bees in laboratory conditions, the OECD has been used as a guide for testing the chemical substances adopted in 21 September1998.

The extract of the residual from the sample is made with acetone, petrol ether and methylene chloride. After mixing and centrifuging, the organic extract evaporates at Rotavapor. The residual is dissolved into a mix of izooctane-toluen, it is used standard intern hexaclorbenzeen; determination is made by GC/ECD/NPD [6].

3. Results and discussion

In order to detect the degree of intoxication of bees to be analyzed by the chromatograph HPLC (High Performance Liquid Chromatography - High performance liquid chromatography), samples of honey contaminated with pesticides were prepared and administered as food for bees from experiences.

Based on the observation on the mortality induced by swallowing honey infected with deltamethrin, we can say that at 5 minutes after the feeding of honey contaminated with deltamethrin 1.25%, 6 individuals died, at concentration of 1% , 4 individuals died , and when the concentration was 0.5%, 3 individuals died (Table 1).

Table 1. Calculation of the correlation and determination coefficients,time depending, for the death rate of the *Apis mellifera* when ingesting deltametrin

Concentration	Polynomial regression equation	Coefficient of determination (R-Sq))	Correlation Coefficient (S)
1.25	$x = -4.235 + 2.147\ y - 0.01111\ y^2$	98.1%	0.968
1	$x = -3.378 + 1.801\ y - 0.007524\ y^2$	98.4%	0.981
0.5	$x = -0.293 + 1.176\ y - 0.001182\ y^2$	97.9%	0.989
0.25	$x = -5.913 + 1.450\ y - 0.003973\ y^2$	98.4%	0.989
0.12	$x = -2.593 + 0.4381y + 0.005905\ y^2$	95.5%	0.969

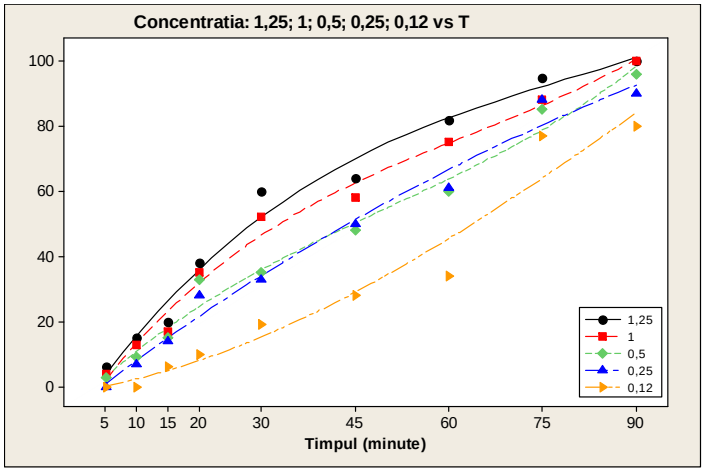

Figure 1.Graphic representations of the death rate of *Apis mellifera* species, in case of *deltametrin* ingestions, time depending

In the case of honey solution contaminated with deltamethrin used in the experiment and the number of dead individuals of the five groups studied, there is a strong positive correlation (Figure 1).

Toxicity reported with the use of honey contaminated with cypermethrin active substance in various concentrations (1.25, 1, 0.5%), is shown in the following table by the number of dead individuals at different time intervals (Table 2).

Table 2. Calculation of the correlation and determination coefficients,time depending, for the death rate of the *Apis mellifera* when ingesting *cipermetrin*

Concentration	Polynomial regression equation	Coefficient of determination (R-Sq))	Correlation Coefficient (S)
1.25	$x = 47.86 + 0.247\ y - 0.010\ y^2$	38.6%	-0.592
1	$x = 42.37 + 0.450\ y - 0.012\ y^2$	35.3%	-0.553
0.5	$x = -22.44 + 5.064\ y - 0.055\ y^2$	79.6%	-0.064
0.25	$x = -4.509 + 1.700\ y - 0.0062\ y^2$	99.4%	0.989
0.12	$x = -11.55 + 1.647\ y - 0.0077\ y^2$	99.2%	0.980

It is observed that after the first five minutes of taking food by the bees, 20 individuals died at a concentration of 1.25% of cypermethrin, 16 individuals at a concentration of 1% and 5 individuals at the concentration of 0.5% . Further, after 30 minutes, was reported the death of all individuals in the experiment at concentrations of 1.25 and 1% of cypermethrin (Figure 2).

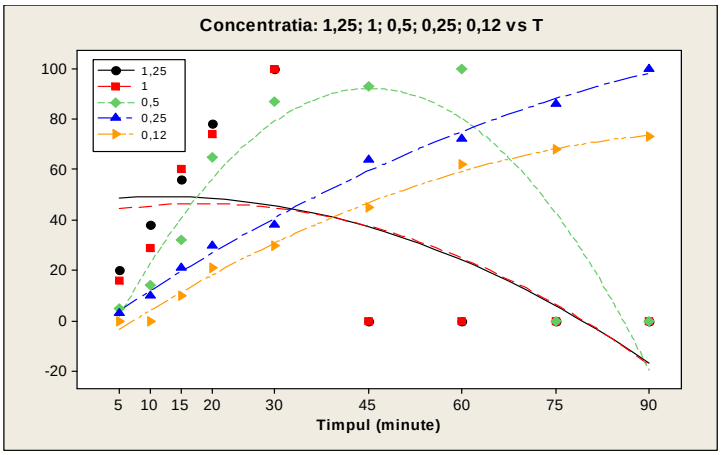

Figure 2. Graphic representations of the death rate of Apis mellifera species, in case of cipermetrin ingestions, time depending, modeled with the help of the second grade polimonial regression

In the case of honey solution contaminated with cypermethrin at a concentration of 1.25% and 1%, the mortality rate of bees there is a moderately negative correlation, if there is concentration of 0.5% there is no correlation, and for concentrations of 0.25% and 0, 12% there is a strong positive correlation.

The administration of honey contaminated with lambda cyhalothrin, the death of the first individuals (2) occurred in 15 minutes at concentrations of 1.25 and 1% respectively. At the concentration of 1.25%, the death of all individuals occurred at 720 minutes. In concentrations of 1 and 0.5% the death of all individuals was reported to 1440 minutes (Table 3).

Table 3. Calculation of the correlation and determination coefficients,time depending, for the death rate of the *Apis mellifera* when ingesting *lambda cihalotrin*

Concentration	Polynomial regression equation	Coefficient of determination (R-Sq))	Correlation Coefficient (S)
1.25	$x = 2.083 + 0.5931\ y - 0.0008\ y^2$	97.7%	-0.062
1	$x = 5.347 + 0.3720\ y - 0.0003\ y^2$	95.8%	0.891
0.5	$x = 1.935 + 0.3239\ y - 0.0002y^2$	99.0%	0.943
0.25	$x = -2.103 + 0.356\ y - 0.0003\ y^2$	99.0%	0.888
0.12	$x = -1.133 + 0.0384\ y - 0.00001\ y^2$	96.1%	0.978

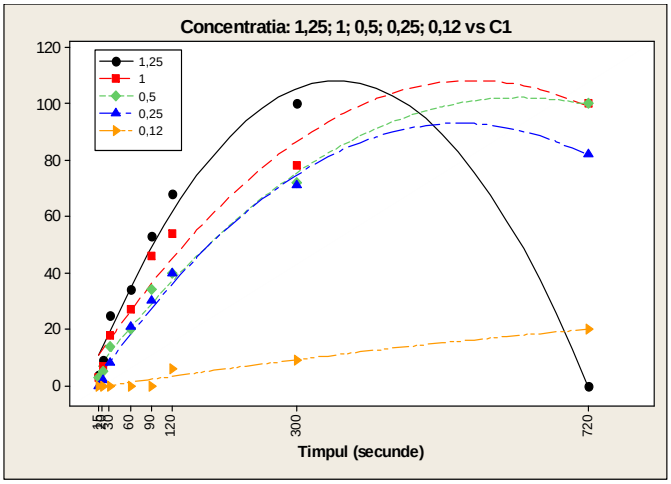

Figure 3. Figure representations of the death rate of Apis mellifera species, in case of lambda cihalotrin, time depending, modeled with the help of the second grade polimonial regression

When honey solution contaminated with 1.25% lambda-cyhalothrin concentration there is no correlation with bee mortality rate, and for all other concentrations studied there is a strong positive correlation (Figure 3)

Bee mortality registered among bees was of seven individuals at five minutes after swallowing honey contaminated with 1.25% imidacloprid, 5 individuals at respectively 3 individuals at concentrations of .25, 1 respectively 0.5%.. At an interval of 45 minutes they died 95, 92 and 87 individuals at concentrations of 1.25, and 0.5% respectively. After 60 minutes all individuals from experience have died regardless of the concentration of active substance (Table 4).

Table 4. Calculation of the correlation and determination coefficients,time depending, for the death rate of the Apis mellifera when ingesting imidacloprid

Concentration	Polynomial regression equation	Coefficient of determination (R-Sq)	Correlation Coefficient (S)
1.25	$x = -20.26 + 3.900\ y - 0.030\ y^2$	95.9%	0.951
1	$x = -18.83 + 3.615\ y - 0.026\ y^2$	97.6%	0.966
0.5	$x = -11.32 + 1.897\ y + 0.0007\ y^2$	97.2%	0.986
0.25	$x = -6.474 + 1.315\ y + 0.006\ y^2$	98.1%	0.989
0.12	$x = 3.402 - 0.2108\ y + 0.021\ y^2$	99.1%	0.960

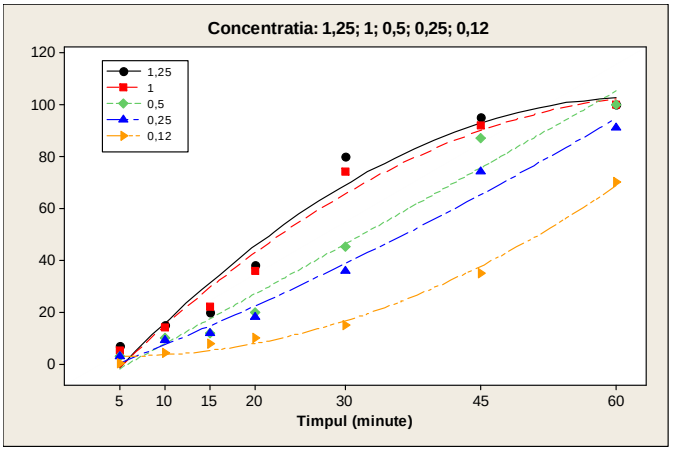

Figure 4. Graphic representations of the death rate of Apis mellifera species, in case of imidacloprid, time depending, modeled with the help of the second grade polimonial regression

In the case of honey contaminated with imidacloprid it is observed from Figure 4 that among all the concentrations used in the experiment and the mortality rate of bees there is a strongly positive correlation.

4. Conclusions

The polynomial regression analysis and correlation coefficients (S) and determination (R-Sq), the conclusions reached are:

- moderately toxic pesticides occurred 70 Leader WG, Decis 2.5 EC and Kalypsos 480 SC, which caused the deaths of bees in 60-90 minutes with low toxicity pesticides have joined Karate Zeon - 1440 minutes Mospilan - 720 minutes, which, moreover, are recommended in agricultural practice.

I recommend the use of transgenic plant varieties that do not require chemical treatments to combat diseases and pests.

5. References

1. Popescu, Gh., Tratat de patologia plantelor vol. I., Edit. Eurobit Timisoara, 2005
2. Bura, M., Pătruică, S., Bura, V. Al., Tehnologie apicolă; Ed. Solness Timişoara, 2005, pp. 380
3. Klaus, F., Purcărea, M., Intoxicaţii acute neprofesionale cu pesticide în rândul populaţiei – situaţia din 2005/ Sănătatea şi Prevenţie, 2006, II 1-4, pp. 99-100
4. Belzunces, L., Colin, M.,Abeilles et pesticides. Effets synergiques des traitements phytosanitaires chez l'abeille des doses sublétales. L'Abeille et le Miel,special avri 1993
5. Badendreier, D., Kalberer, N., Romei,s J., Fluri, P., Bibler, F., Pollen comsumption in honey bee larvae: a step Fprward in the risk assessment of transgenic plants. Apidologie, 2004, 35, 293-300
6. Harry, M., Pylypiw, Jr., Rapid gaz-chromatoggraphic method for the multiresidue screening of fruits and vegetables for organochlorine and organophosphate pesticide, Journal of A.O.A.C., 1993, 76 (6)