



# Testing insecticides efficacy on pollen beetles (*Meligethes aeneus* F.)



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## Introduction

Oilseed rape (*Brassica napus* subsp. *napus*) is a bright-yellow flowering member of the family *Brassicaceae*, cultivated mainly for its oil-rich seed. The productivity is severely damaged by several pathogens and pest's species causing high economic losses. During the present study one of the most important rape pest, pollen beetle (*Meligethes aeneus* F.) was examined. The pollen beetle can cause high damage if the weather is cold for a longer time, because in this case the bud and flowering phase lasts longer [2]. Up to 80% yield loss can be expected under favorable conditions [3].

A questionnaire was sent to European countries to gain some background information on rape growing and on pollen beetle (*Meligethes aeneus*). In total 20 countries responded and resistance in pollen beetle was reported in 12 of those countries [5].

**Guidelines for the control of pollen beetle:** most insecticides attack the nervous system of insects, inhibit its function, nerve impulses are transmitted as electrical signals. The impulse reaches the gaps (synapses) between the nerve cells with the help of chemical mediators, like acetylcholine [14]. The above-mentioned process can be inhibited in several places and can be exploited by appropriate insecticidal interventions:

1. by inhibition of the enzyme acetylcholinesterase (organophosphates, carbamates)
2. by inhibiting the binding of acetylcholine to the receptor (nicotine, neonicotinoids)
3. by inhibiting the permeability of Na<sup>+</sup> ion channels (pyrethroids) [14].

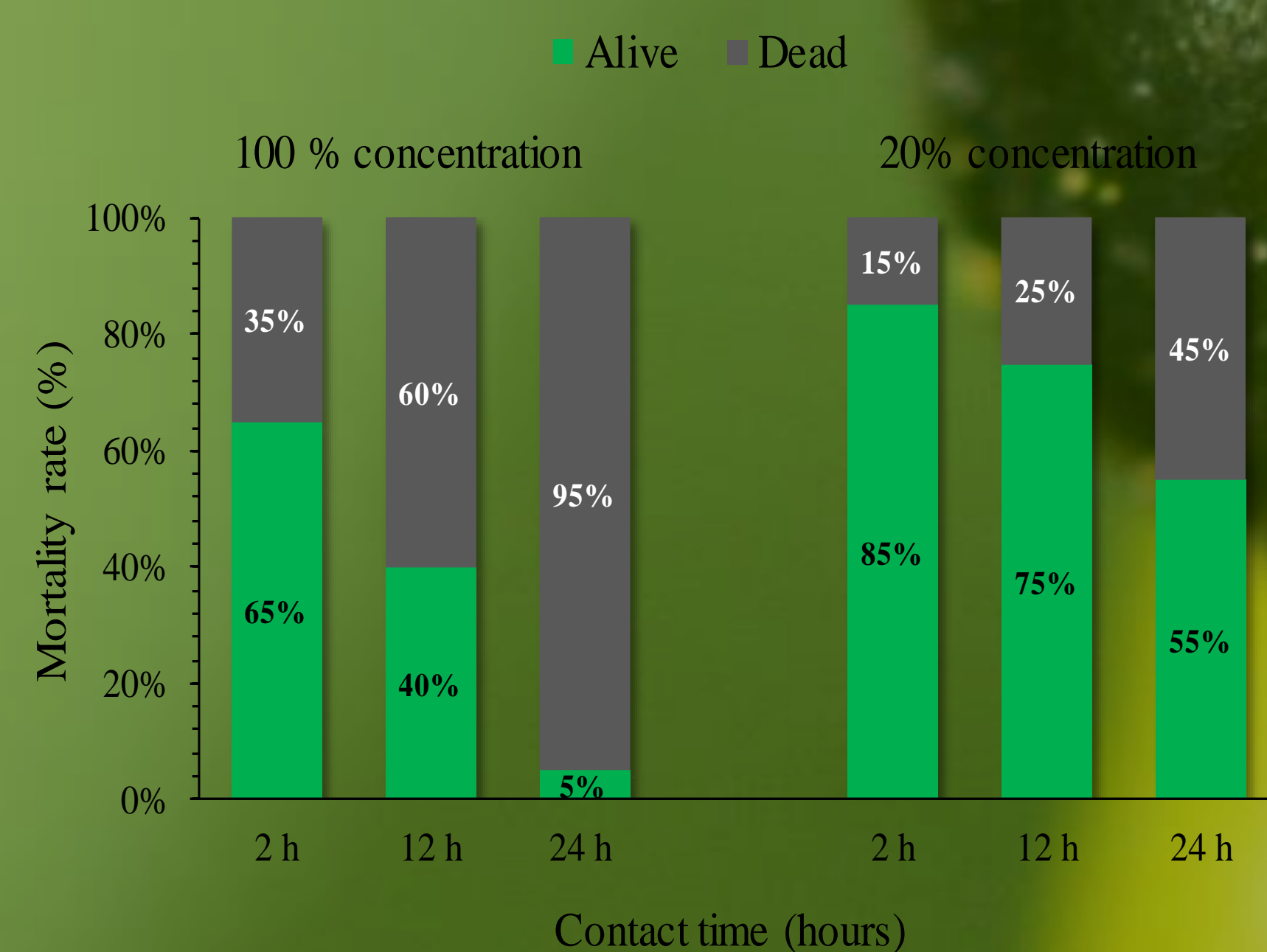


Fig.1- Efficacy of *lambda-cyhalothrin* on pollen beetle adults (second method)

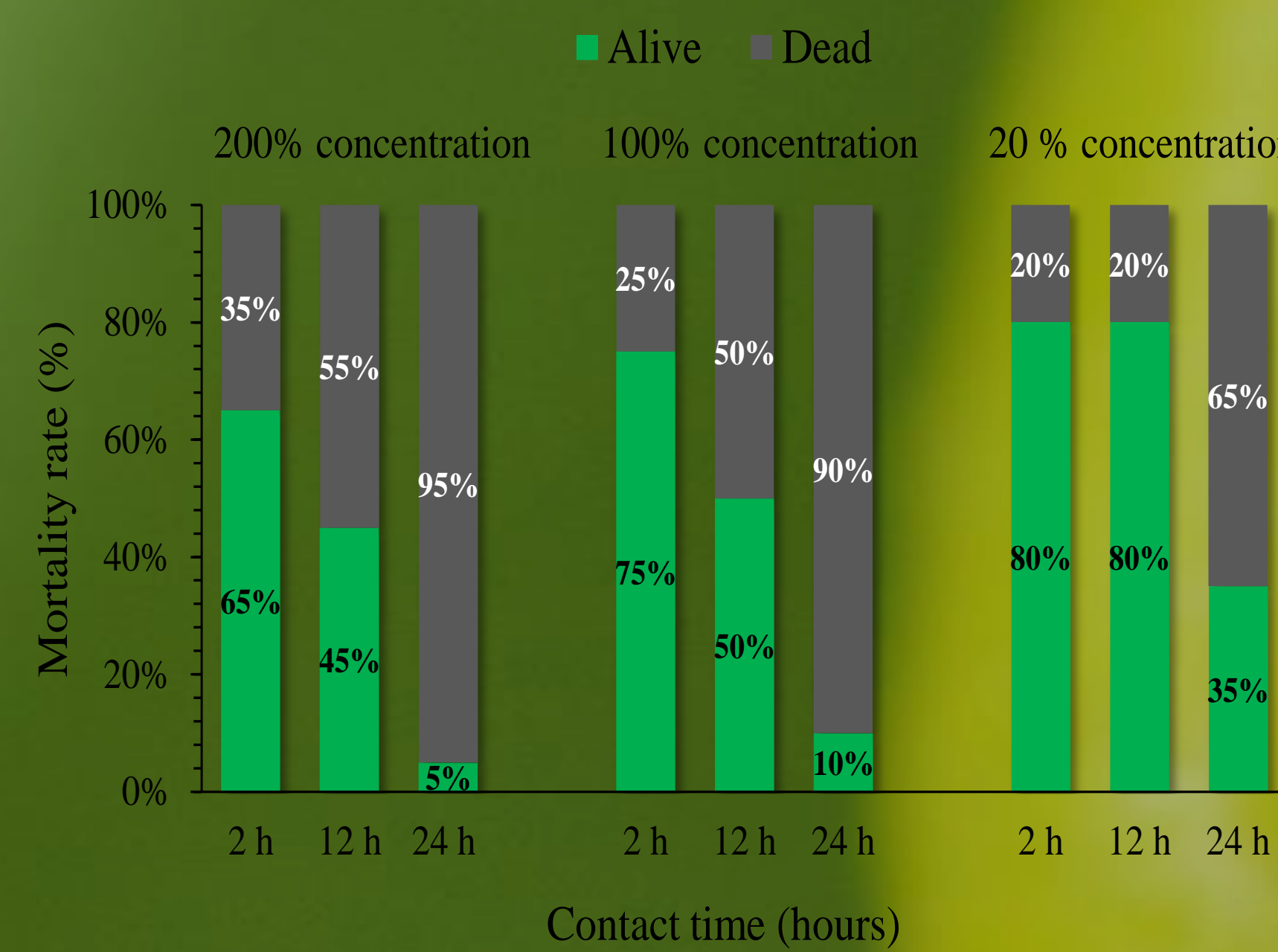


Fig.2- Efficacy of *acetamiprid* on pollen beetle adults (second method)

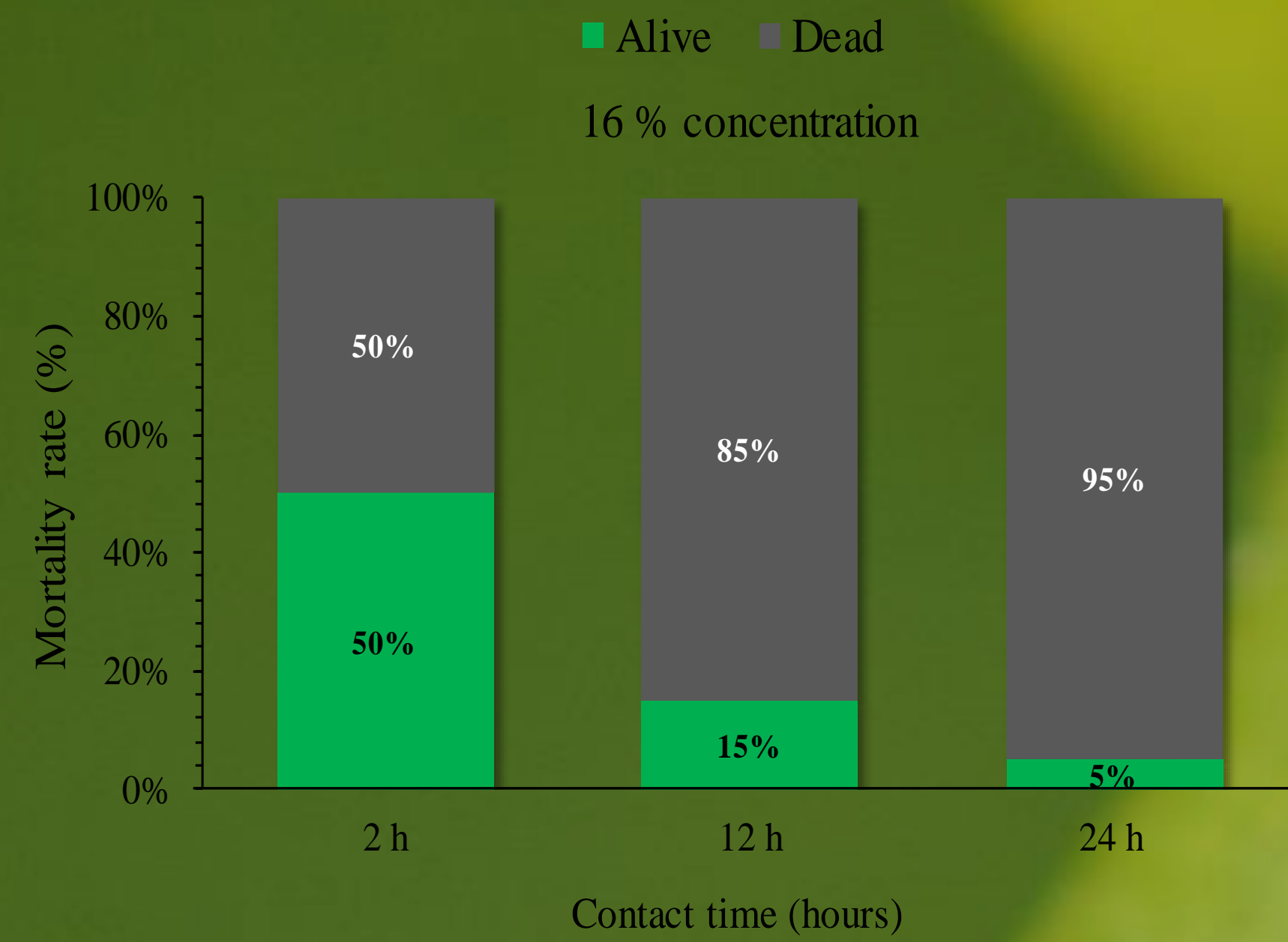


Fig.3- Efficacy of *dimethoate* on pollen beetle adults (second method)

## Results

During the processing of results, we did not find any significant differences after performing the pesticide resistance test recommended by the Insecticide Resistance Action Committee (IRAC) and the test we developed and performed.

The pyrethroid treatments with *lambda-cyhalothrin* (Karate Zeon 50 CS) and *deltamethrin* (Decis Mega 50 EW) caused 35% mortality rate after 2 hours with 100% concentration and 60% after 12 hours. For the results measured after 24 hours, the mortality was close to 100% (Fig.1). No significant differences were found between the two methods.

The neonicotinoid treatments with *thiacloprid* (Calypso 480 SC) and *acetamiprid* (Mospilan 20 SG) caused 40% mortality rate after 2 hours at 200% concentration treatment, and above 50% after 12 hours. After 24 hours the mortality rate was higher than 90%. At 100% concentration, the survival rate was higher after 2 hours, 75% of the individuals were alive. After 12 hours the proportion changed to 50%. After 24 hours only one alive individual was found. The treatment at 20% concentration had the highest survival rate. After 2 hours 80% of the individuals were alive, after 12 hours it showed stagnation and after 24 hours more than 60% of individuals died (Fig.2). No significant differences were found between the two methods.

The organophosphate treatment with *dimethoate* (Novadim Progress) caused an 50% mortality rate after 2 hours at 16% concentration. After 12 hours the survival rate went under 20%. After 24 hours the mortality rate was above 90% (Fig.3).

## Material and Methods

The pollen beetle adults were collected a total of two times from an oilseed rape field located 6 km far from Targu Mures. The first individuals were collected on April 28, 2018, and the date of the second collection was May 6, 2018. A total number of 500 individuals on each period were collected from rape fields near Târgu-Mureș. The insects were carried in to the Sapientia University's laboratory where we set up the experiment.

Insecticides used in the experiment:

1. *lambda-cyhalothrin* (Karate Zeon 50 CS)
2. *deltamethrin* (Decis Mega 50 EW)
3. *thiacloprid* (Calypso 480 SC) and
4. *acetamiprid* (Mospilan 20 SG)
5. *dimethoate* (Novadim Progress)

Two experimental insecticides resistance method were used.

### Description of the first method (IRAC):

During a collection approx. 500 adults (*Meligethes aeneus* F.) were collected from different points of the oilseed rape field. After collecting necessary number of individuals, we put them into a holding cage for 24 hours and put some oil seed rape leaves plus two or three rape inflorescences as food source. After the collection we carried them to the laboratory and could rest for 12 hours. Standard IRAC tools were used according to descriptions. The planned concentrations of each insecticides were measured in µg/cm<sup>2</sup>, and then the necessary amount was carefully considered. Two replicates were followed for each experiment and concentrations. We used a total of 26 vials, two of them were used as control. 1.5 ml of distilled water were used for each vial and the measured insecticides were added to the water. For the control vials, we used 1.5 ml of acetone. At room temperature the vials were rotated in horizontal position under laminar box until the water and the acetone had evaporated. Once 10-10 adults were used for every vial. Then under microscope the survival rate was assessed for each individual after 2, and then after 12 and 24 hours.

### Description of the new method:

Standard Petry dishes were used during the second experiment. We used total of 26 Petry dishes similarly with the first method, two of them formed the control. The pre-measured insecticides were filled into a 0.5L hand sprayer, an adhesion promoter was added due to character of Petry dishes and then we sprayed twice from the same distance on both side of the Petry dishes. After drying we put 10-10 adult in each Petry dish. Under microscope the survival rate was assessed for each individual after 2, and then afand 24 hours.

Data analyzes: The IRAC susceptibility rating scheme was used to evaluate the results for the treatments of pyrethroids (*lambda-cyhalotrin*-Karate Zeon, *deltametrin*-Decis Mega 50 EW) (Tab.1) and organophosphates (*dimethoate*-Novadim Progress) (Tab.2).

Concentration (% of label rate)	Affected	Classification	Code
100%	100%	Highly Susceptible	1
20%	100%		
100%	100%	Susceptible	2
20%	<100%		
100%	<100% to >90%	Moderately Resistant	3
100%	<90% to >50%	Resistant	4
100%	<50%	Highly Resistant	5

Table.1- Susceptibility rating scheme-*pyrethroids*

Rate	% affected	Classification	Code
0.3 µg/cm <sup>2</sup>	≤ 100 to 90	Susceptible	1
0.3 µg/cm <sup>2</sup>	<90	Potential to be tolerant	2

Table.2- Susceptibility rating scheme-*organophosphates*

## Discussion

After performing the experiment and processing the data, it can be concluded that no susceptible populations of pollen beetle were detected around Târgu-Mureș and the treatments were effective against the adult pollen beetles. The importance of the present experiment should also be emphasized because it has already been indicated in several Western European countries that insecticides (*pyrethroids*, *neonicotinoids*, *organophosphates*) used against pollen beetle have no effect and they developed resistance against insecticides. Therefore, the standard concentrations can be used to control pollen beetles but the principal mechanisms in the insecticide's effects must be followed to reduce the possibility of induced resistance of pollen beetles against particular compound.

## References

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