# MAJOR PEST INSECTS' RESISTANCE TO INSECTICIDES IN OILSEED RAPE PLANTATIONS IN POLAND AND RESISTANCE MANAGEMENT STRATEGIES


Prof. dr hab. Paweł Węgorek

Joanna Zamojska, PhD

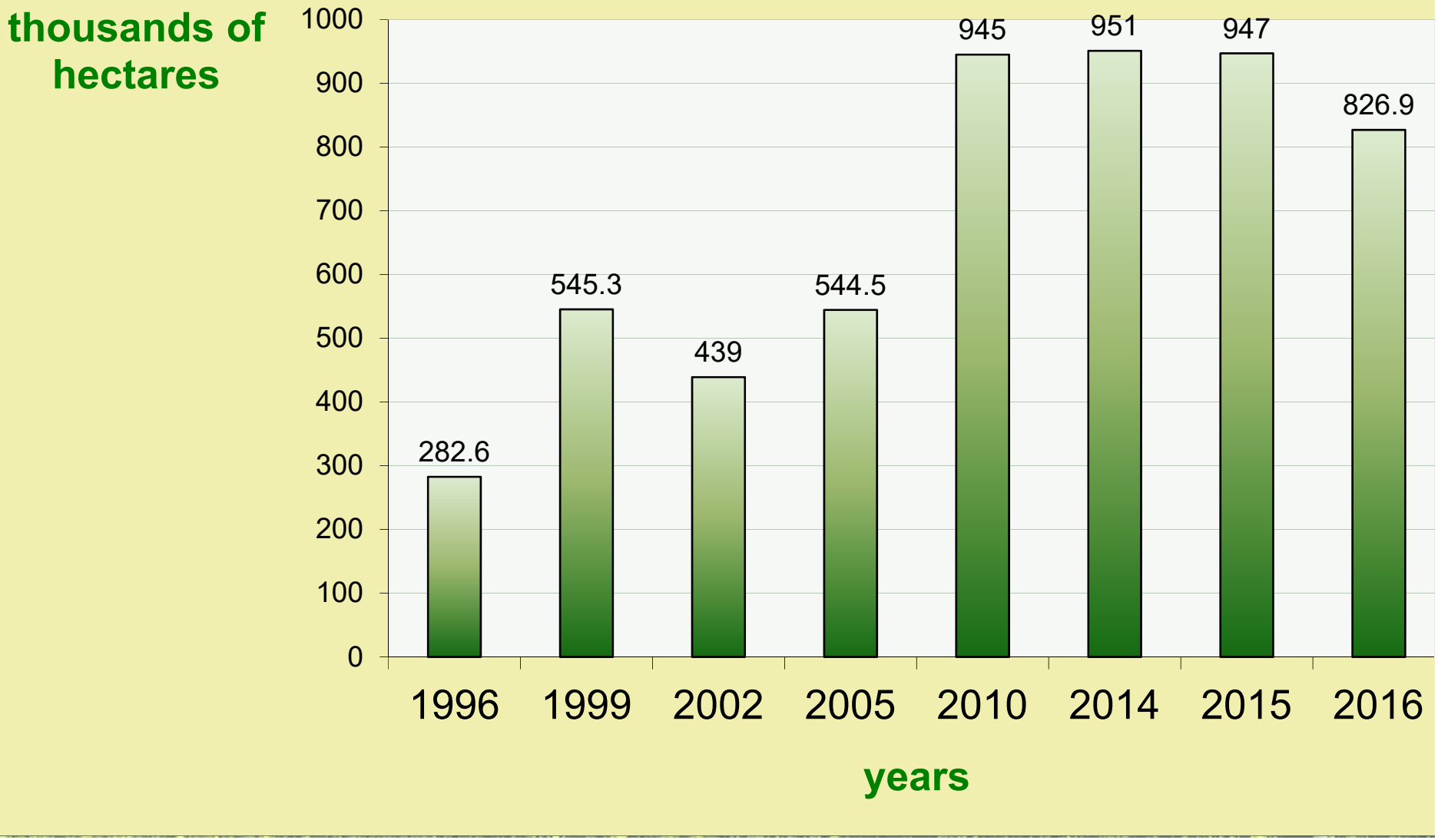
Przemysław Strażyński , PhD

Daria Dworzańska, MSc.

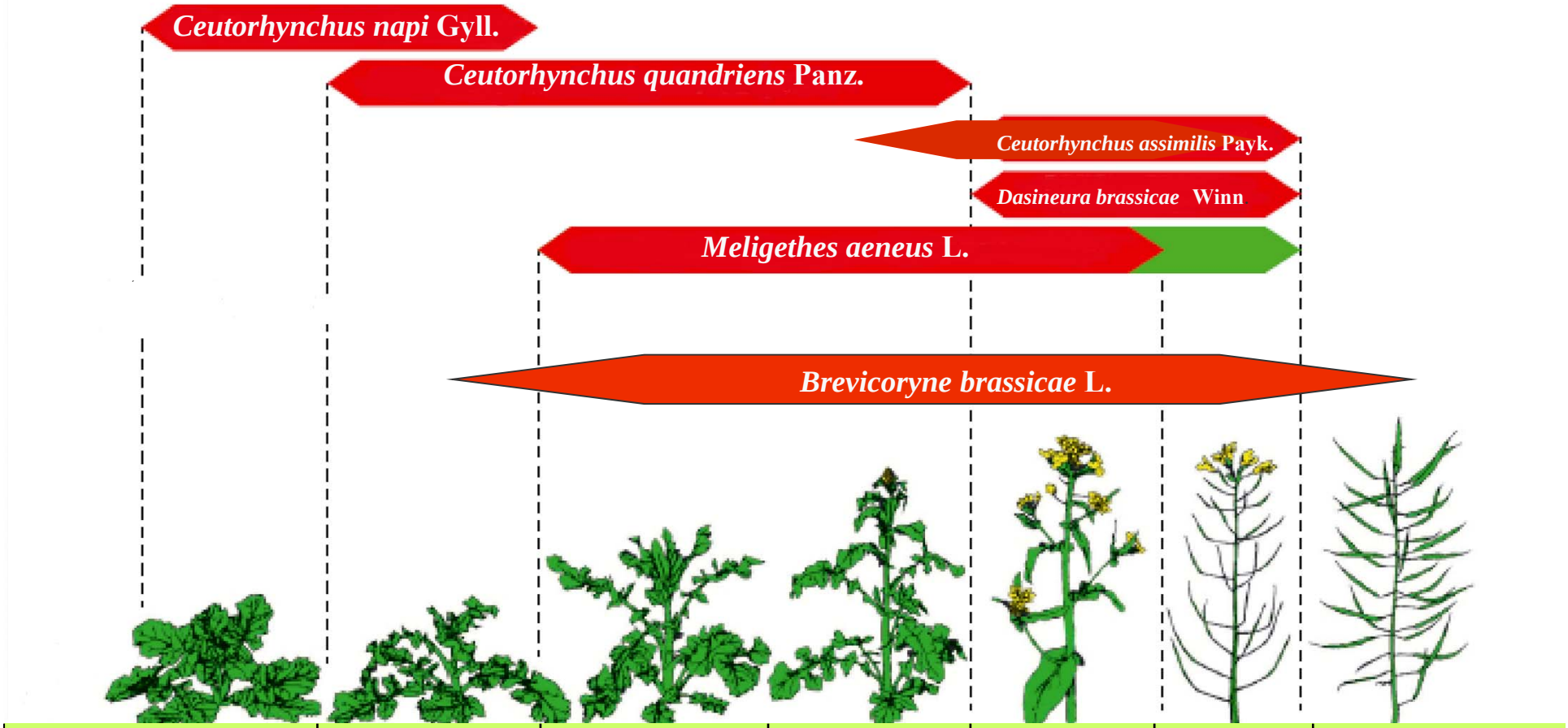
**INSTITUTE OF PLANT PROTECTION – NATIONAL RESEARCH INSTITUTE**

**POZNAŃ, POLAND**

# AREA OF RAPESEED PLANTATIONS IN POLAND



# OCCURRENCE OF MAJOR PESTS DURING GROWTH OF OILSEED RAPE




| Formation of side shoots BBCH 20-29 | Growth (stem elongation) (beginning of stem elongation) BBCH 30-39 | Emergence of buds (green bud) BBCH 51 | Emergence of buds (yellow bud) BBCH 55-59 | Flowering (first flowers open) BBCH 60 | Flowering (end) BBCH 69 | Formation and development of siliqu BBCH 70-79 |
|---|---|---|---|---|---|---|
| MARCH | APRIL | | | MAY | | JUNE |

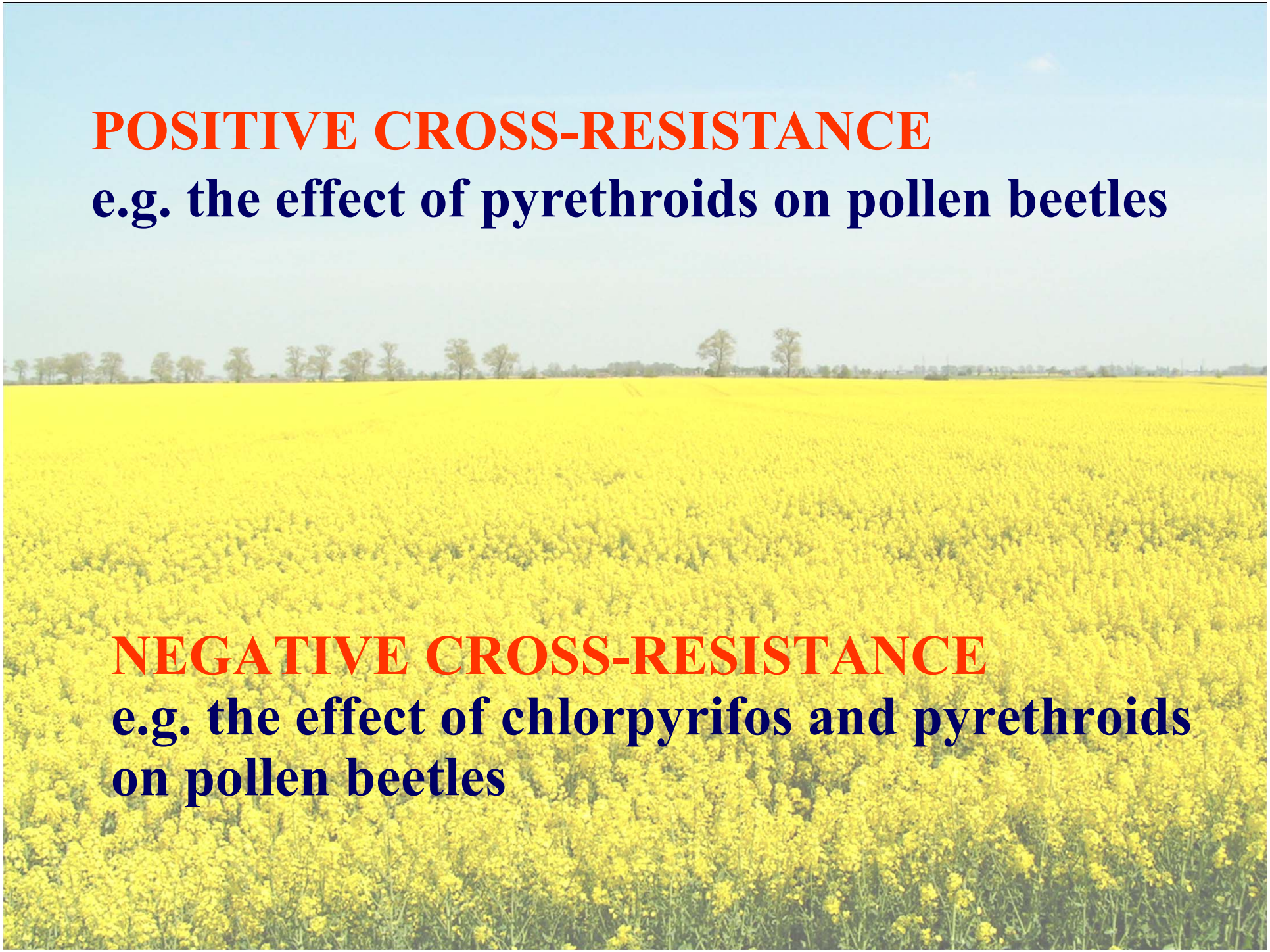
*Meligethes aeneus* F.

**BBCH 50-52: 1-2 beetles per plant**
**BBCH 55-59: 3-5 beetles per plant**

*Ceutorhynchus assimilis* Payk
**BBCH: 57- 69: 1 beetle per plant**

| Insecticide group | Active substance | Number of insecticides | Mode of action |
|---|---|---|---|
| Pyrethroids | alpha-cypermethrin | 13 | prevent closure of voltage-gated sodium channel (IRAC 3 A) |
| | beta-cyfluthrin | 5 | |
| | cypermethrin | 15 | |
| | deltamethrin | 13 | |
| | esfenvalerate | 2 | |
| | lambda-cyhalothrin | 19 | |
| | tau-fluvalinate | 2 | |
| | zeta-cypermethrin | 9 | |
| Aryl propyl ethers | etofenprox | 1 | prevent closure of voltage-gated sodium channel (IRAC 3 A) |
| Neonicotinoids | acetamiprid | 16 | ACHR (acetylcholine receptor) – substitute acetylcholine (IRAC 4 A) |
| | thiacloprid | 3* | |
| Organophosphates | chlorpyrifos ethyl | 27 | ACHE (acetylcholinesterase) – inhibit acetylcholinesterase (IRAC 1 B) |
| | chlorpyrifos methyl | 1 | |
| | malathion | 1 | |
| | phosmet | 1 | |
| Oxadiazines | indoxacarb | 2 | block voltage-gated sodium channel (IRAC 22 A) |
| Pyridine azometines | pymetrozine | 1 | selective feeding blockers (9 B) |

# SPRING RAPE


POSITIVE CROSS-RESISTANCE
e.g. the effect of pyrethroids on pollen beetles
NEGATIVE CROSS-RESISTANCE
e.g. the effect of chlorpyrifos and pyrethroids on pollen beetles

# Monitoring pollen beetles' resistance to pyrethroids and oxadiazines

| ACTIVE SUBSTANCE | HIGH SUSCEPTIBILITY | SUSCEPTIBILITY | LOW RESISTANCE | MEDIUM RESISTANCE | HIGH RESISTANCE | MORTALITY AT RECOMMENDED DOSES |
|---|---|---|---|---|---|---|
| ALPHA-CYPERMETHRIN | | | | X | | 55-85 |
| CYPERMETHRIN | | | | X | | 60-85 |
| DELTAMETHRIN | | | | X | X | 30-65 |
| ESFENVALERATE | | | | X | | 55-70 |
| LAMBDA-CYHALOTHRIN* | | | X | X | X | 30-92 |
| TAU-FLUVALINATE | | | X | X | | 80-98 |
| ZETA-CYPERMETHRIN | | | | X | X | 45-80 |
| INDOXACARB | X | | | | | 100 |

# Monitoring pollen beetles' resistance to neonicotinoids and organophosphates

| ACTIVE SUBSTANCE | HIGH SUSCEPTIBILITY | SUSCEPTIBILITY | LOW RESISTANCE | MEDIUM RESISTANCE | HIGH RESISTANCE | MORTALITY AT RECOMMENDED DOSES |
|---|---|---|---|---|---|---|
| ACETAMIPRID | | | X | X | | 75-98 |
| THIACLOPRID | | | X | X | | 75-98 |
| CHLORPYRIFOS | X | | | | | 100 |
| CHLORPYRIFOS METHYL | X | | | | | 100 |
| MALATHION | X | X | | | | 100 |
| PHOSMET | X | X | X | | | 98-100 |

# Monitoring cabbage seed weevils' resistance to pyrethroids and oxadiazines

| ACTIVE SUBSTANCE | HIGH SUSCEPTIBILITY | SUSCEPTIBILITY | LOW RESISTANCE | MEDIUM RESISTANCE | HIGH RESISTANCE | MORTALITY AT RECOMMENDED DOSES |
|---|---|---|---|---|---|---|
| ALPHA-CYPERMETHRIN | X | | | | | 100 |
| BETA-CYFLUTHRIN | X | | | | | 100 |
| CYPERMETHRIN | X | | | | | 100 |
| DELTAMETHRIN | X | | | | | 100 |
| ESFENVALERATE | X | | | | | 100 |
| LAMBDA-CYHALOTHRIN* | X | | | | | 100 |
| TAU-FLUVALINATE | | | X | X | X | 35–90 |
| ZETA-CYPERMETHRIN | X | | | | | 100 |
| INDOXACARB | | | | | X | 0–5 |

# Monitoring cabbage seed weevils' resistance to neonicotinoids and organophosphates

| ACTIVE SUBSTANCE | HIGH SUSCEPTIBILITY | SUSCEPTIBILITY | LOW RESISTANCE | MEDIUM RESISTANCE | HIGH RESISTANCE | MORTALITY AT RECOMMENDED DOSES |
|---|---|---|---|---|---|---|
| THIACLOPRID | | X | X | | | 98–100 |
| CHLORPYRIFOS | X | | | | | 100 |
| CHLORPYRIFOS METHYL | X | | | | | 100 |
| MALATHION | X | | | | | 100 |
| PHOSMET | X | | | | | 100 |

# OXADIAZINES AND PYRETHROIDS

## INDOXACARB

| DOSE [PPM] | POLLEN BEETLE | CABBAGE SEED WEEVIL |
|---|---|---|
| 135 | 100 | 0 |
| 67.5 | 100 | 0 |
| 33.75 | 100 | 0 |
| 16.87 | 99 | 0 |
| 8.43 | 98 | 0 |

## CYPERMETHRIN

| DOSE [PPM] | POLLEN BEETLE | CABBAGE SEED WEEVIL |
|---|---|---|
| 161 | 45 | 100 |
| 80.5 | 30 | 100 |
| 40.25 | 5 | 100 |
| 20.12 | 0 | 100 |
| 10.06 | 0 | 70 |

# THE RESISTANCE PREVENTION STRATEGY AS AN ELEMENT OF INTEGRATED PLANT PROTECTION


FAVOURABLE
RESISTANCE☺

| SUBSTANCE | YEARS OF RESEARCH | GOOD CONDITION | WORSE CONDITION | DEATH | CLASSIFICATION |
|---|---|---|---|---|---|
| ALPHA-CYPERMETHRIN | 6 | 2 | 2 | 2 | DANGEROUS ??? |
| CYPERMETHRIN | 3 | 2 | 1 | 0 | RISKY |
| DELTAMETHRIN | 10 | 4 | 5 | 1 | DANGEROUS??? |
| LAMBDA-CYHALOTHRIN | 2 | 2 | 0 | 0 | ? |
| TAU-FLUVALINATE | 8 | 8 | 0 | 0 | SAFE |
| ETOFENPROX | 5 | 3 | 2 | 0 | RISKY |
| ACETAMIPRID | 10 | 10 | 0 | 0 | SAFE |
| THIACLOPRID | 5 | 5 | 0 | 0 | SAFE |
| CHLORPYRIFOS | 3 | 2 | 0 | 1 | DANGEROUS ??? |
| CHLORPYRIFOS METHYL | 1 | 1 | 0 | 0 | ? |
| MALATHION | 1 | 1 | 0 | 0 | ? |
| PHOSMET | 1 | 1 | 0 | 0 | ? |
| INDOXACARB | 6 | 3 | 2 | 1 | DANGEROUS ??? |
| PYMETROZINE | 3 | 1 | 2 | 0 | RISKY |

# CURRENT EXPERIMENTS – NOT SO BAD ☺

**IMIDACLOPRID – JUST SLIGHT SIGNALS OF POISONING**
**THIAMETOXAM - JUST SLIGHT SIGNALS OF POISONING**
**CLOTHIANIDIN - JUST SLIGHT SIGNALS OF POISONING**
**CHLORPYRIFOS - JUST SLIGHT SIGNALS OF POISONING**
**CHLORPYRIFOS METHYL - JUST SLIGHT SIGNALS OF POISONING**

**DELTAMETHRIN – NO SIGNALS OF POISONING**

# ACETAMIPRID


# BBCH 33-54

**CHLORPYRIFOS, MALATHION, PHOSMET**
**– CONSIDERABLE DAMAGE FROM POLLEN BEETLES**

**PYRETHROID**
**– LESSER DAMAGE FROM POLLEN BEETLES**
**– CONSIDERABLE DAMAGE FROM CABBAGE STEM WEEVILS**

# BBCH 55 - 59

**INDOXACARB**

**– CONSIDERABLE DAMAGE FROM POLLEN BEETLES**

**NEONICOTINOID**

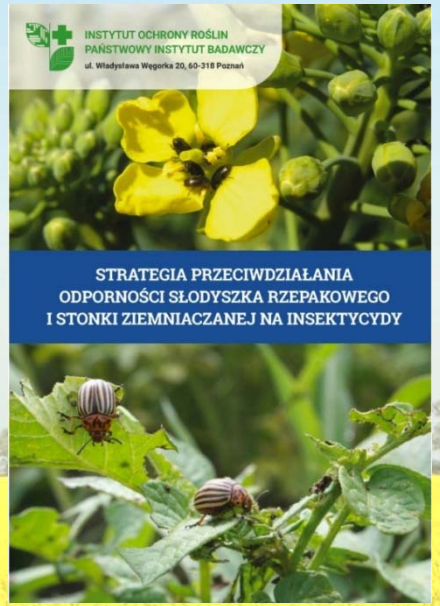
**– ACCORDING TO FORECAST EMERGENCE OF PESTS AT CONSECUTIVE PHASES**

# BBCH 66-69

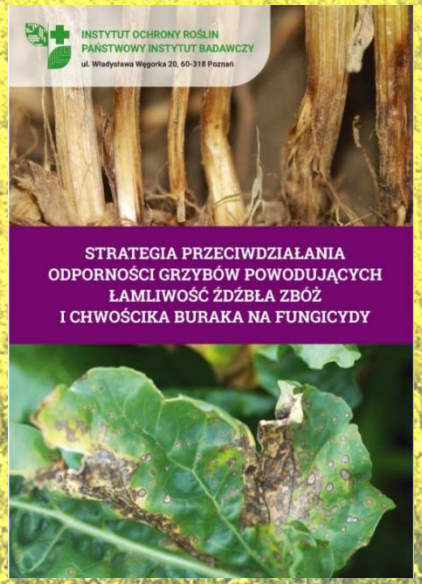
**PYRETHROID** – CONSIDERABLE DAMAGE FROM CABBAGE STEM WEEVILS

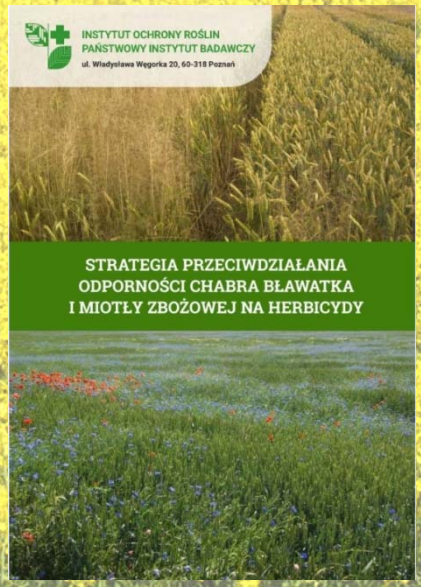
**NEONICOTINOID** CONSIDERABLE DAMAGE FROM POLLEN BEETLES

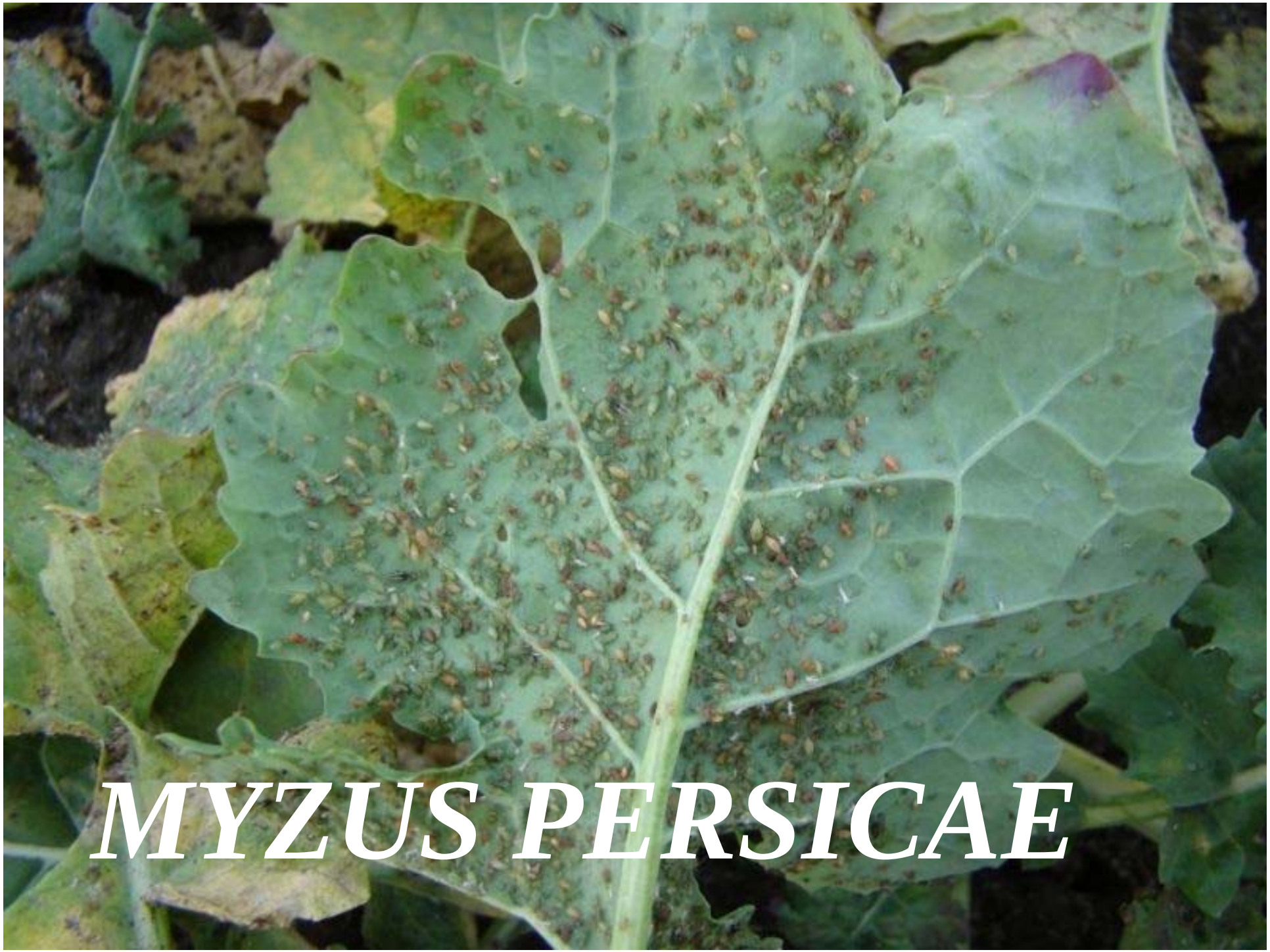

INSTYTUT OCHRONY ROŚLIN
PAŃSTWOWY INSTYTUT BADAWCZY
ul. Władysława Węgorka 20
60-318 Poznań
SŁODYSZEK RZEPAKOWY
na kwiatostanie rzepaku
STRATEGIA
ZAPOBIEGANIA ODPORNOŚCI
SŁODYSZKA RZEPAKOWEGO
W POLSCE
POZNAŃ, kwiecień 2009


INSTYTUT OCHRONY ROŚLIN
PAŃSTWOWY INSTYTUT BADAWCZY
ul. Władysława Węgorka 20, 60-318 Poznań
STRATEGIA PRZECIWDZIAŁANIA
ODPORNOŚCI SŁODYSZKA RZEPAKOWEGO
I STONKI ZIEMNIACZANEJ NA INSEKTYCYDY


INSTYTUT OCHRONY ROŚLIN
PAŃSTWOWY INSTYTUT BADAWCZY
ul. Władysława Węgorka 20, 60-318 Poznań
DOBRA PRAKTYKA ROLNICZA
PRZECIWDZIAŁAJĄCA
ODPORNOŚCI AGROFAGÓW
NA ŚRODKI OCHRONY ROŚLIN
POZNAŃ, listopad 2013

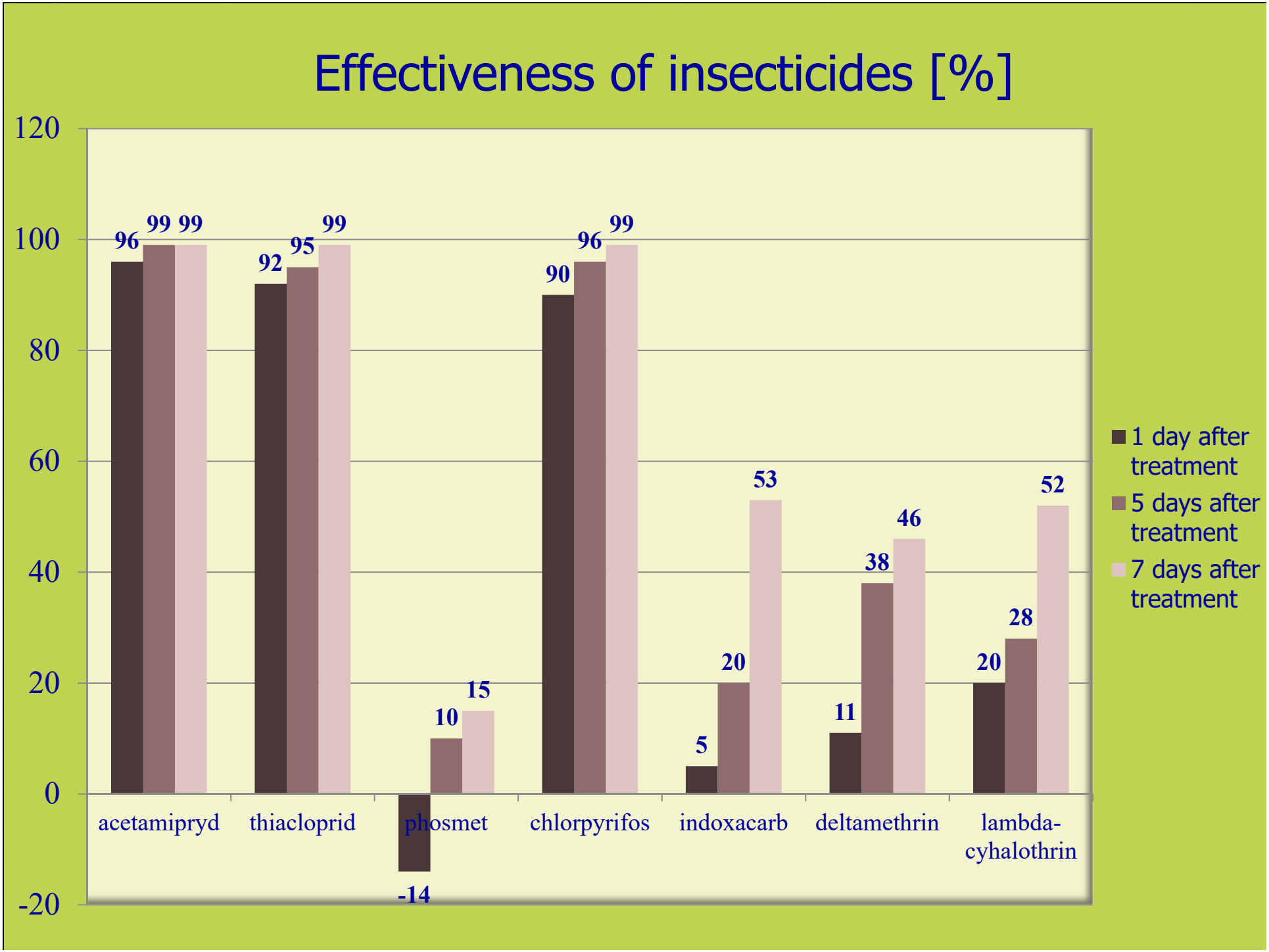

INSTYTUT OCHRONY ROŚLIN
PAŃSTWOWY INSTYTUT BADAWCZY
ul. Władysława Węgorka 20, 60-318 Poznań
STRATEGIA PRZECIWDZIAŁANIA
ODPORNOŚCI GRZYBÓW POWODUJĄCYCH
ŁAMLIWOŚĆ ŹDŹBŁA ZBÓŻ
I CHWOŚCIKA BURAKA NA FUNGICYDY


INSTYTUT OCHRONY ROŚLIN
PAŃSTWOWY INSTYTUT BADAWCZY
ul. Władysława Węgorka 20, 60-318 Poznań
STRATEGIA PRZECIWDZIAŁANIA
ODPORNOŚCI CHABRA BŁAWATKA
I MIOTŁY ZBOŻOWEJ NA HERBICYDY


MYZUS PERSICAE


MYZUS PERSICAE

# Effectiveness of insecticides [%]




THANK YOU FOR YOUR ATTENTION