Determination of baseline toxicity of insecticides to *Tuta absoluta*

Emmanouil Roditakis

National Agricultural
Research Foundation
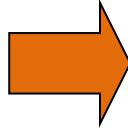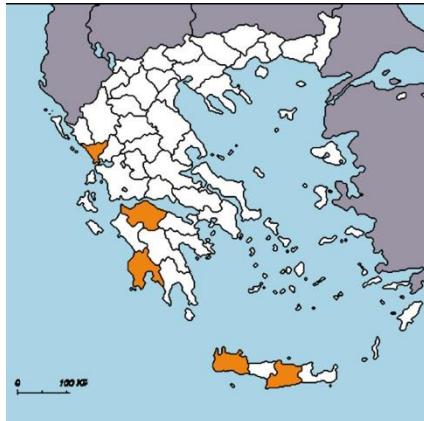
Tuta absoluta (Lepidoptera: Gelechiidae)

A new very serious pest of tomato ...

... that invaded Greece in 2009
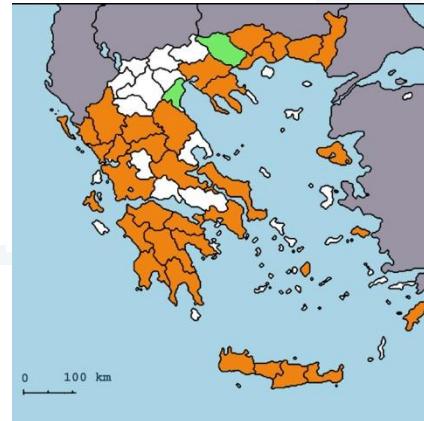
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NOV '09

Tuta absoluta

A new very serious pest of tomato …

Integrated Management of *Tuta absoluta*

- Detection

- Prevention

- Control
   - *Preservation / release of natural enemies*
   - *Rational use of registered insecticides*

Integrated Management of *Tuta absoluta*

- Detection

- Prevention

- Control

  - *Preservation / release of natural enemies*
  - ***Rational use of registered insecticides***
    8 active ingredients
    belonging to 7 different MOAs

Base line toxicity for *T. absoluta*
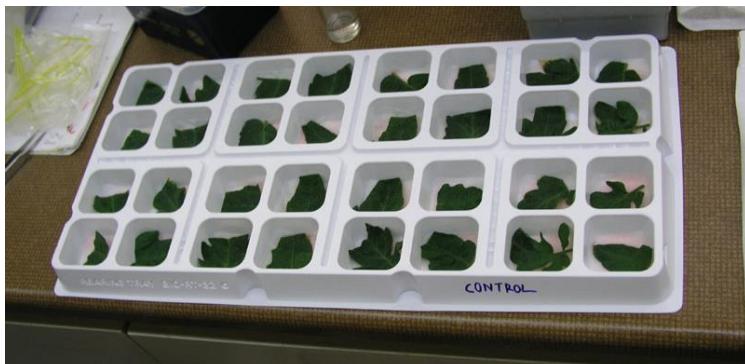
Aim of the study:
Evaluation of susceptibility of
Tuta absoluta to registered insecticides

Method 022 / IRAC

Method
Modified leaf dip bioassay
(Validated in collaboration with Du Pont) **DUPONT**

- Thirty two 2nd instar larvae / dose
- 72 h / estimation of mortality %

Base line toxicity for *T. absoluta*

Method
Modified leaf dip bioassay

Damaged

Protected

Base line toxicity for *T. absoluta*

Insecticides tested

Registered insecticides for *Tuta absoluta in Greece*		
Group	**Trade name**	**Active ingredient**
Diamides	ALTACOR 35 WG	clorantraniliprole / Rynaxypyr®
	BELT 24 WG	flubendiamide
Avermectins	AFFIRM 095 SG	emamectin benzoate
Spinosyns	LASER 480 SC	spinosad
Oxadiazine	STEWARD 30 WG	indoxacarb
Semicarbazone	ALVERDE 24 SC	metaflumizone
Organophosphate	PYRINEX 25 CS	chlorpyriphos
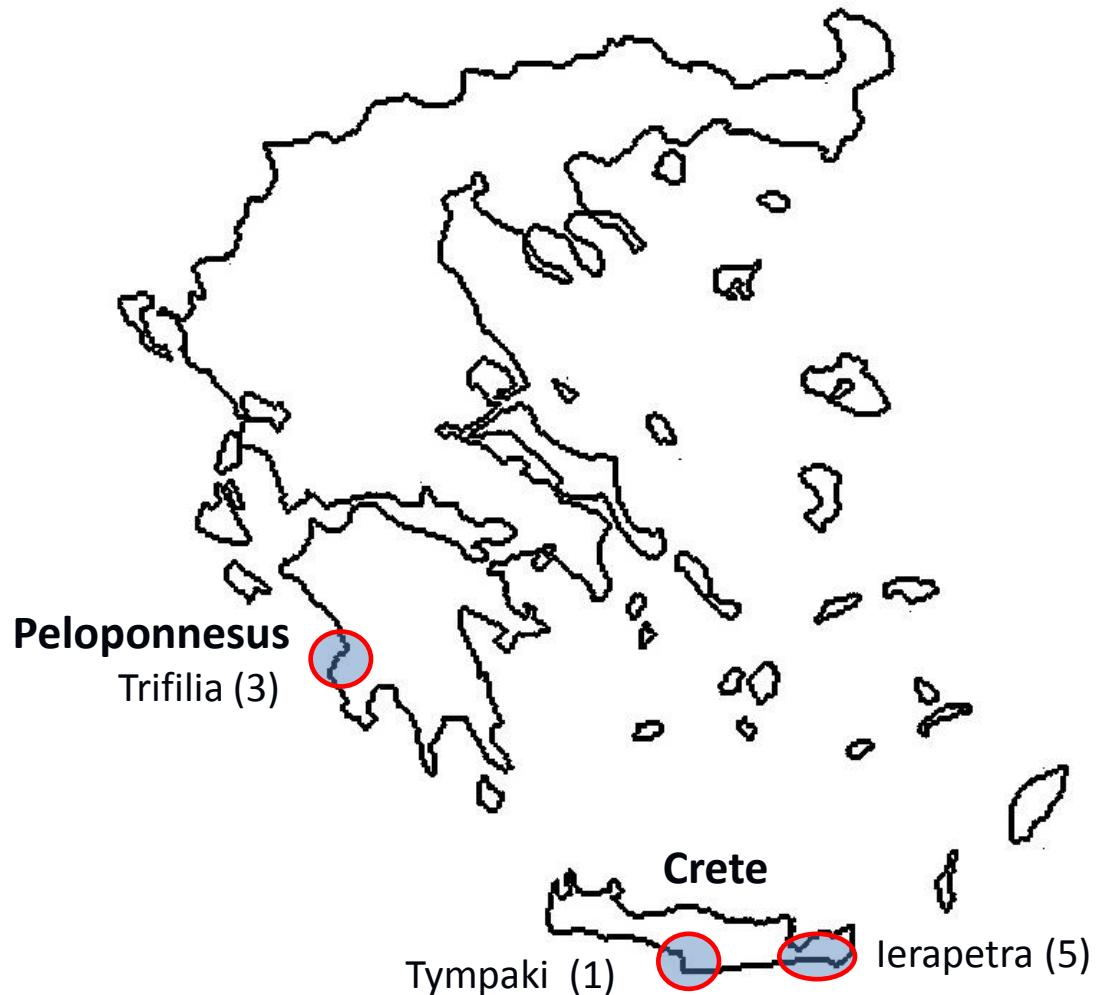
Registered insecticide for Lepidoptera control in tomato crops		
Group	**Trade name**	**Active ingredient**
Pyrethroid	ASSIST 10EC	cypermethrin

Populations tested

Nine (9) populations were tested in total

Collection Sites

Peloponnesus
Trifilia (3)

Crete

Tympaki (1) Ierapetra (5)

Base line toxicity for *T. absoluta*

Technical issues when performing the bioassay

-Larvae availability

- Handling of L2 larvae

Base line toxicity for *T. absoluta*

Technical issues : Larvae availability

Need of aprox. 200 L2 larvae for one experiment

Problem:
Rapid destruction of plants in *T. absoluta* rearing cages (by L3-L4)

=> food deprived / stressed L2 larvae

=> time consuming detection in a rearing cage

Base line toxicity for *T. absoluta*

Technical issues : Larvae availability

Synchronous oviposition

Base line toxicity for *T. absoluta*

Technical issues : Larvae availability

Synchronous oviposition

Oviposition

Development of L1

Base line toxicity for *T. absoluta*

Technical issues : Handling of L2 larvae

Problem:

L2 = Difficult to detect

L2 = Small delicate larvae easily injured

= high control mortality

Base line toxicity for *T. absoluta*
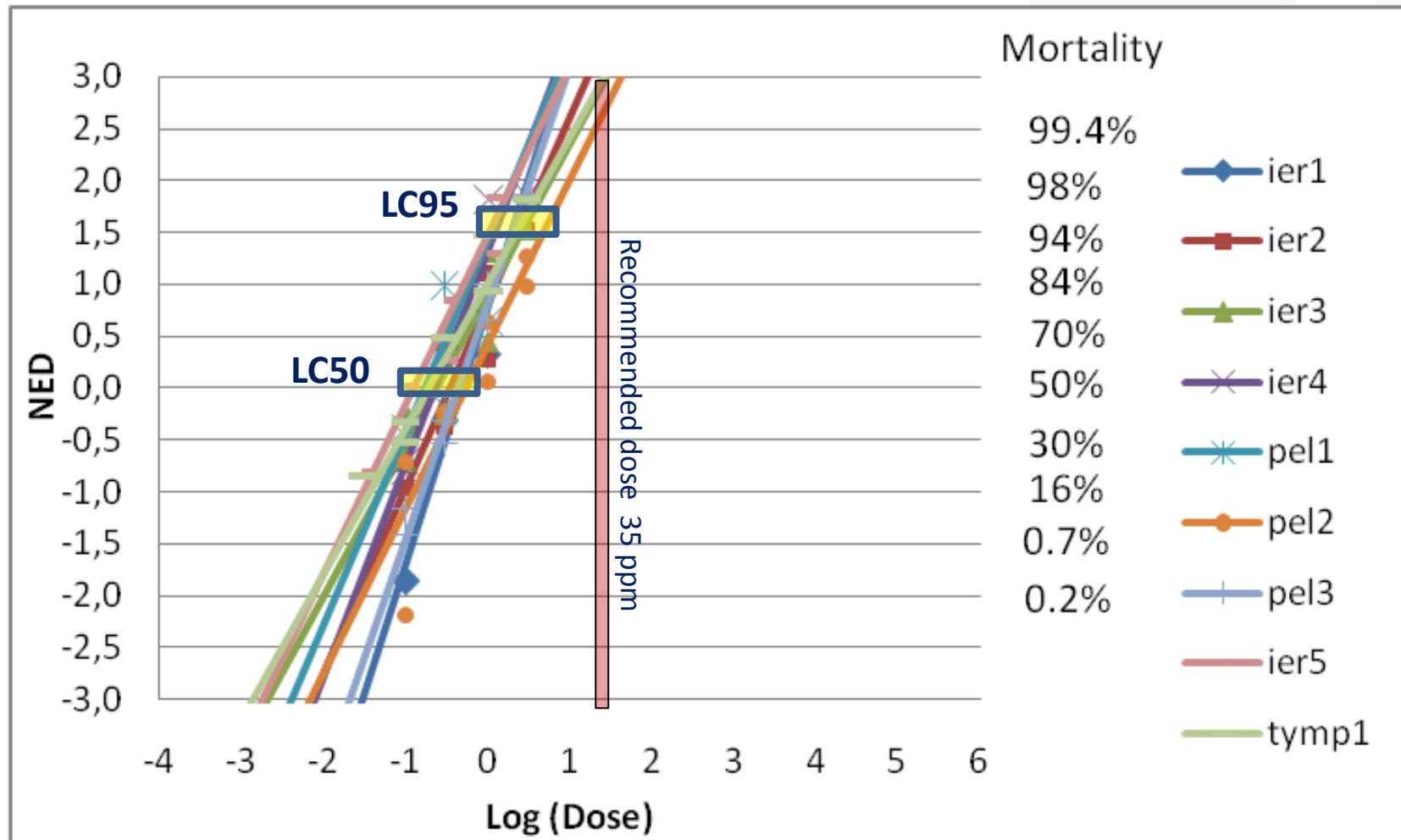
**Technical issues : Handling of L2 larvae**

Use of a light bed

Results

Results: clorantraniliprole / Rynaxypyr ®

N=9

X^2 = Low values, no statistical difference ($P<0.05$)

NED = normal equivalent deviation = probit units - 5

LC50 : 0.12 – 0.55 (x5)

LC95 : 1.23 – 5.71

Recommended dose: *35 ppm*

Results : clorantraniliprole / Rynaxypyr ®

| Population	LC_{50}	CL 95%		LC_{95}	slope	X^2	df	RR
IER5	0.12	0.08 - 0.16	a	1.23	1.6	6.7	8	1
PEL1	0.17	0.08 - 0.27	ab	1.32	1.9	21.2	8	1
TYMP1	0.18	0.11 - 0.27	ab	2.73	1.5	6.0	8	2
IER4	0.22	0.17 - 0.28	b	1.41	2.1	3.7	8	2
IER3	0.23	0.12 - 0.38	abc	3.17	1.5	15.3	8	2
IER2	0.35	0.22 - 0.51	c	2.89	1.8	14.3	8	3
PEL3	0.43	0.33 - 0.53	c	2.23	2.3	3.2	8	4
PEL2	0.53	0.32 - 0.80	c	5.71	1.6	10.7	8	4
IER1	0.55	0.38 - 1.08	c	3.51	2.0	2.0	1	5

N=9
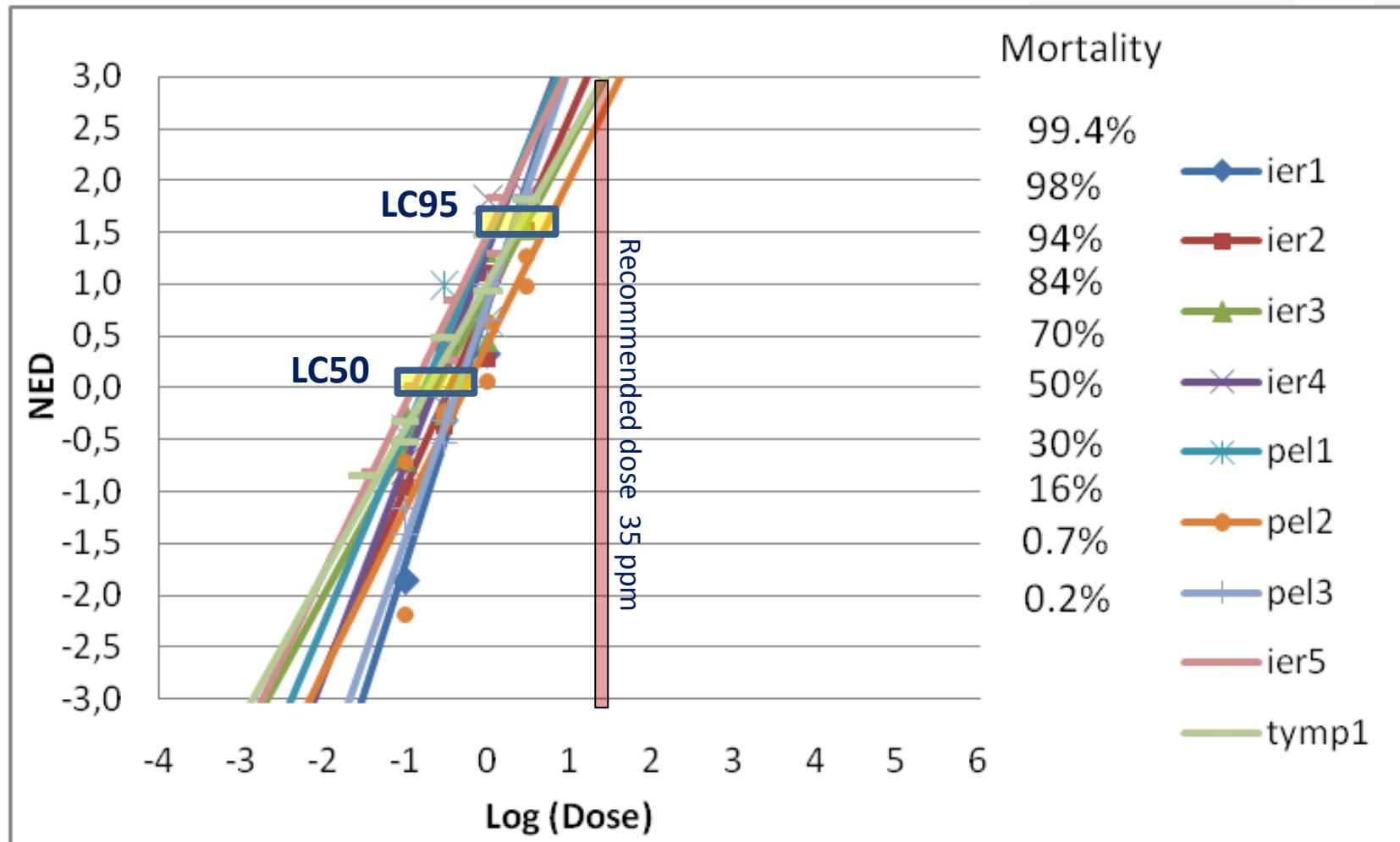
X^2 = Low values, no statistical difference
($P<0.05$)

LC50 : 0.12 – 0.55 (x5)

LC95 : 1.23 – 5.71

Recommended dose: *35 ppm*

# Results : clorantraniliprole / Rynaxypyr ®

N=9
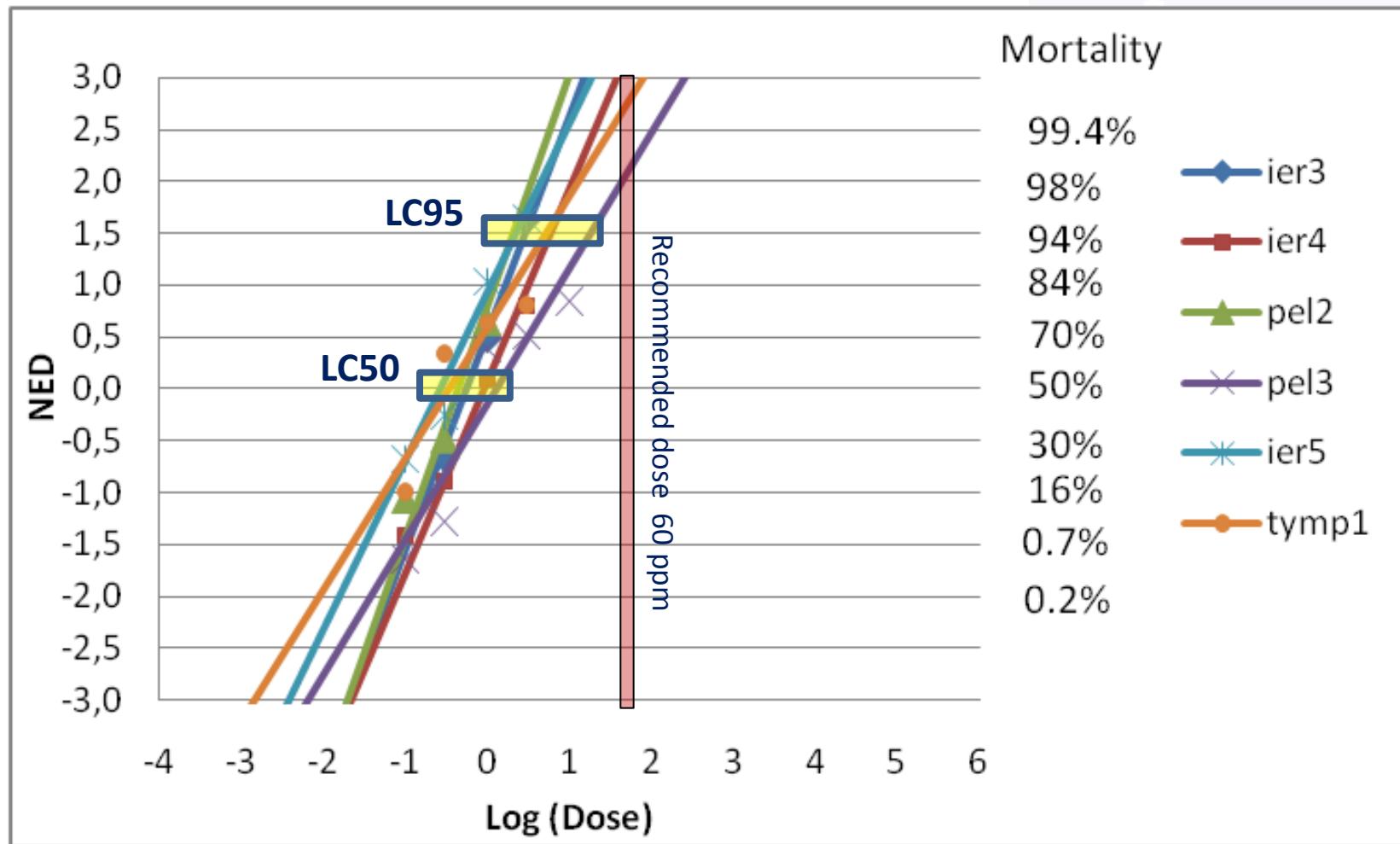
X^2 = Low values, no statistical difference
(*P*<0.05)

LC50 : 0.12 – 0.55 (x5)
LC95 : 1.23 – 5.71
Recommended dose: *35 ppm*

# Results : flubendiamide

N=6
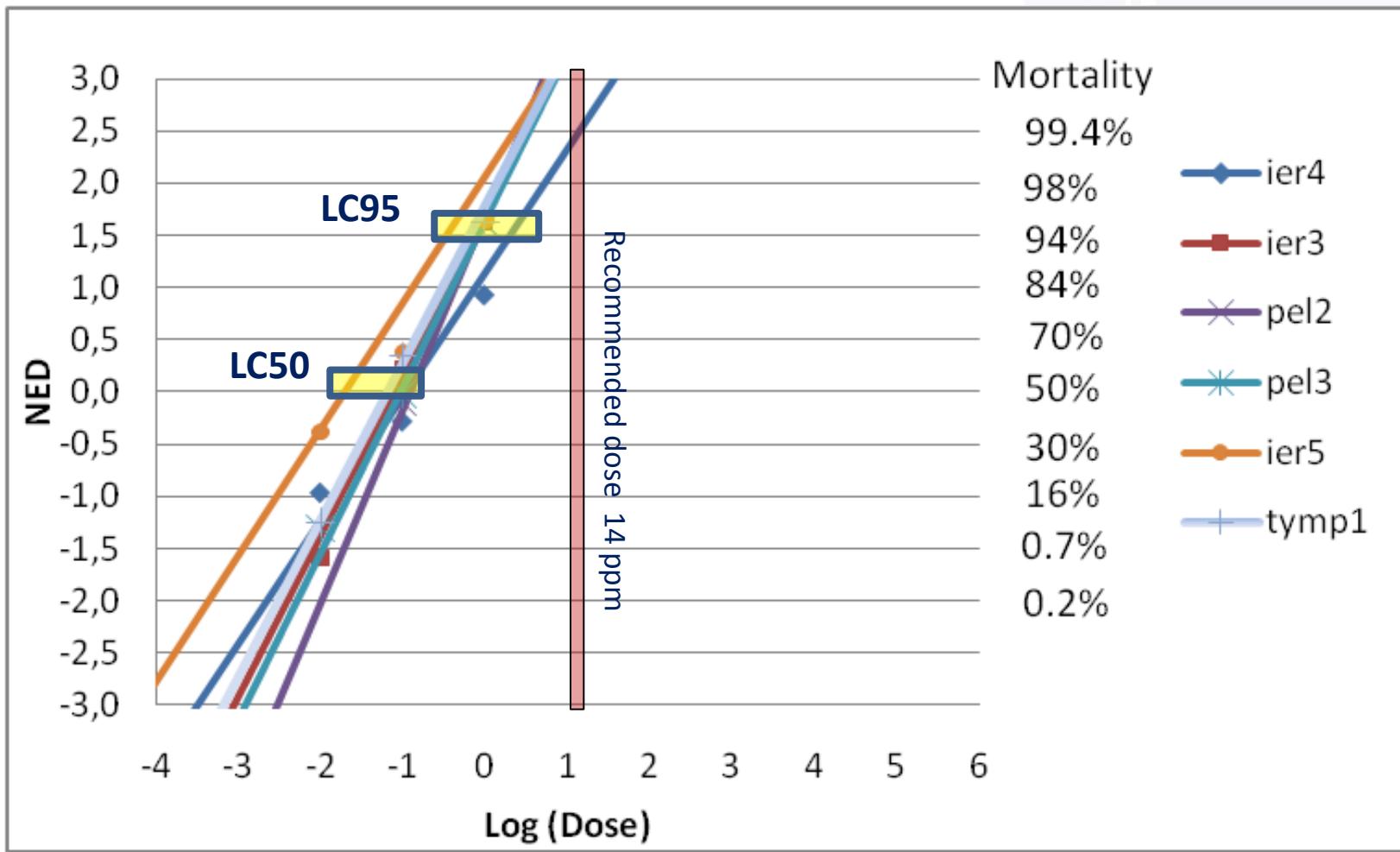
X^2 = No statistical difference ($P<0.05$)

LC50 : 0.33 – 1.3 (x4)

LC95 : 3.17 – 23.1

Recommended dose : *60 ppm*

Results : emamectin benzoate

N=6
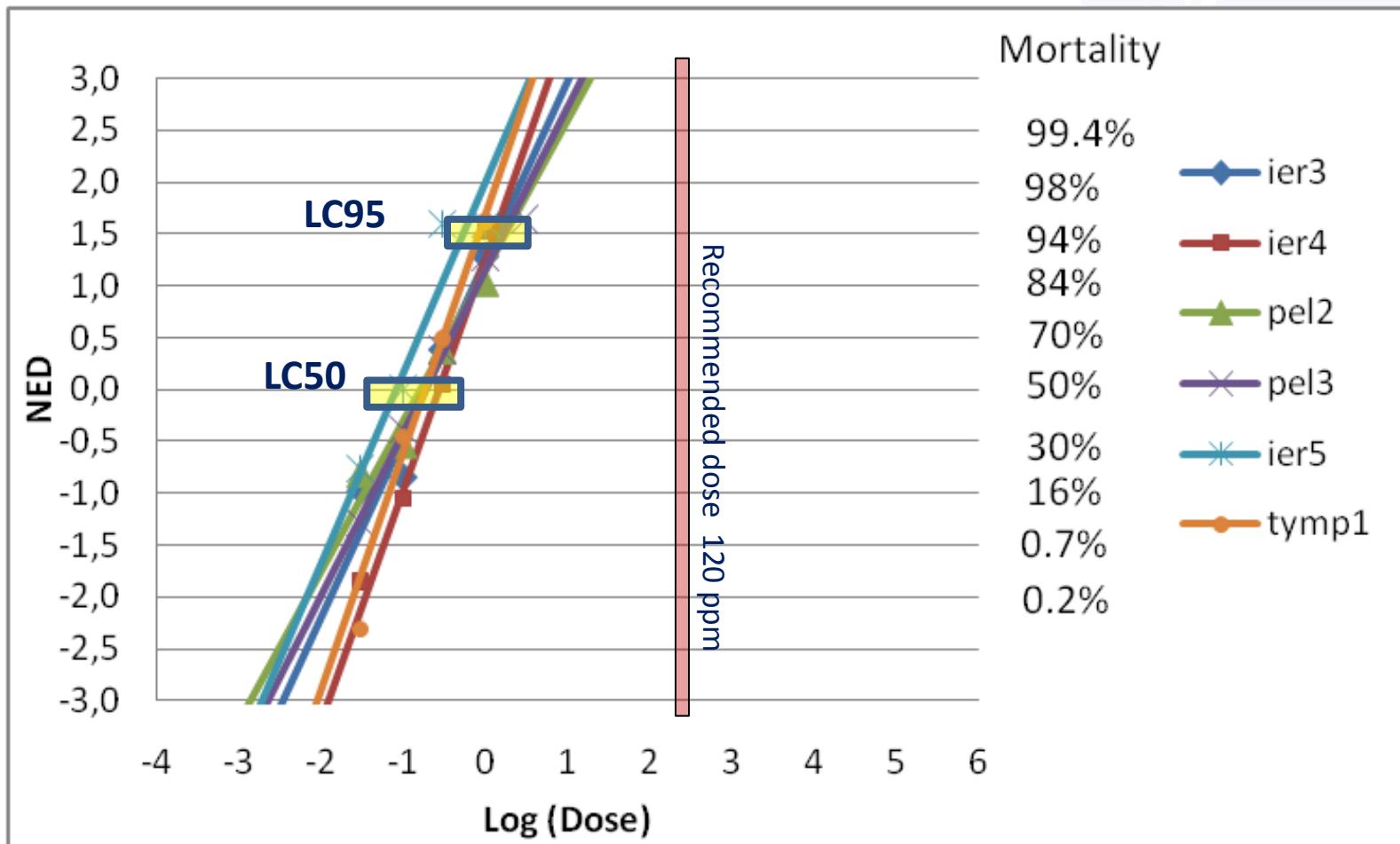
X^2 = No statistical difference ($P<0.05$)

LC50 : 0.03 – 0.13 (x4)

LC95 : 0.87 – 7.3

Recommended dose : *14 ppm*

Results : spinosad
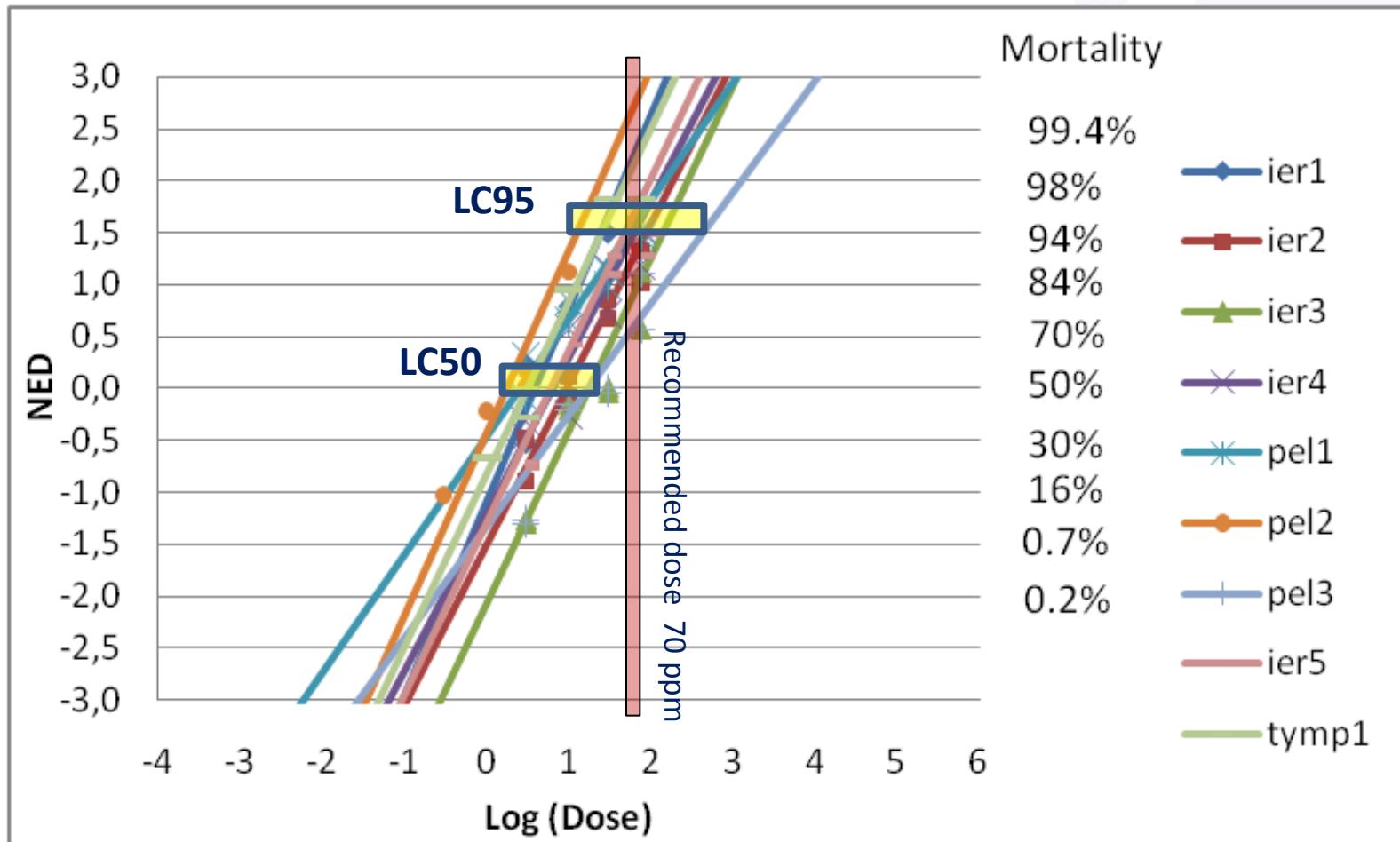
N=6
X^2 = No statistical difference ($P<0.05$)

LC50 : 0.08 – 0.26 (x3)
LC95 : 0.97 – 3.23
Recommended dose : *120 ppm*

Results : indoxacarb

N=9
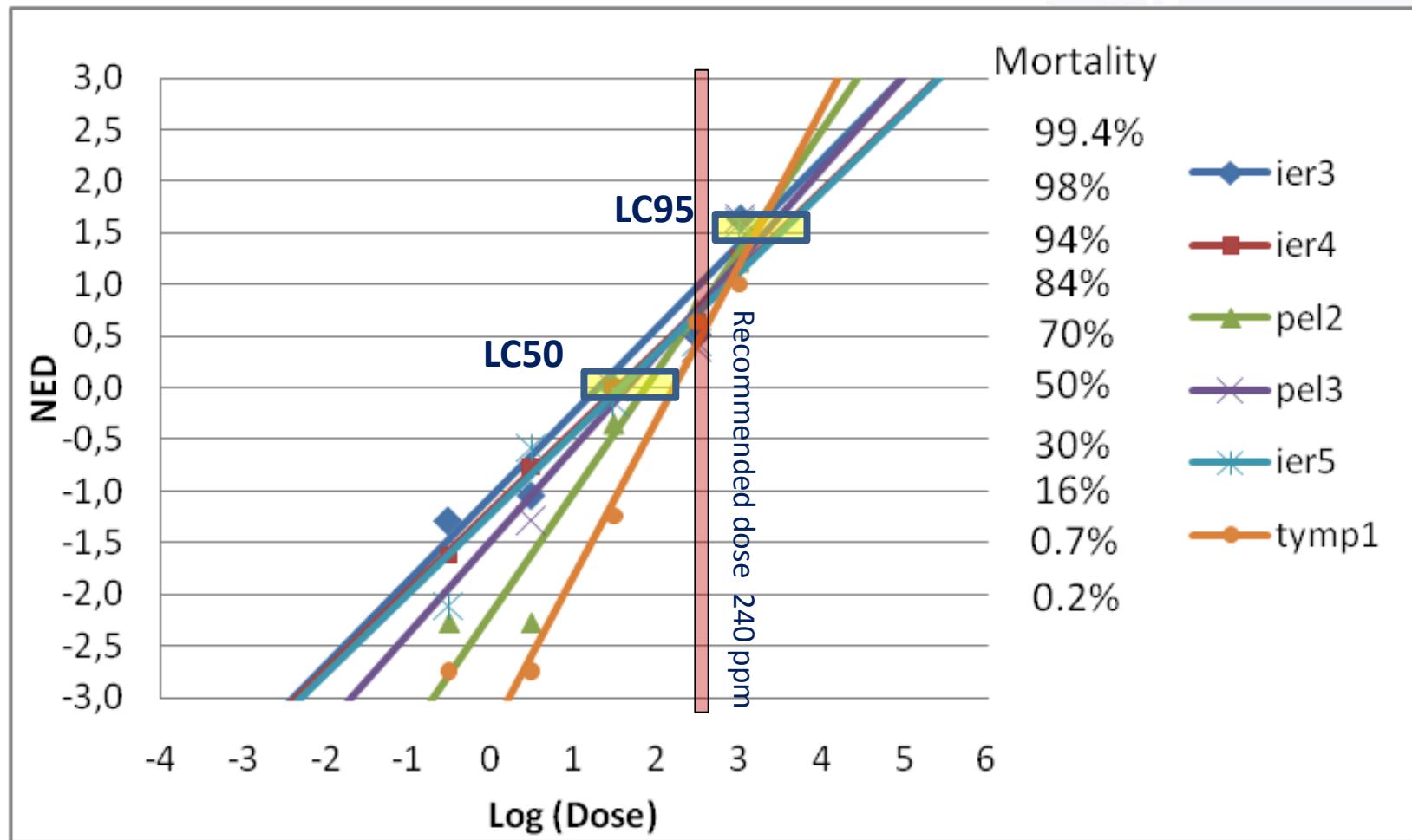
X^2 = No statistical difference $(P<0.05)$

LC50 : 1.7 – 17.5 **(x10)**

LC95 : 14.9 – 567

Recommended dose : *70 ppm*

Results : metaflumizone

N=6
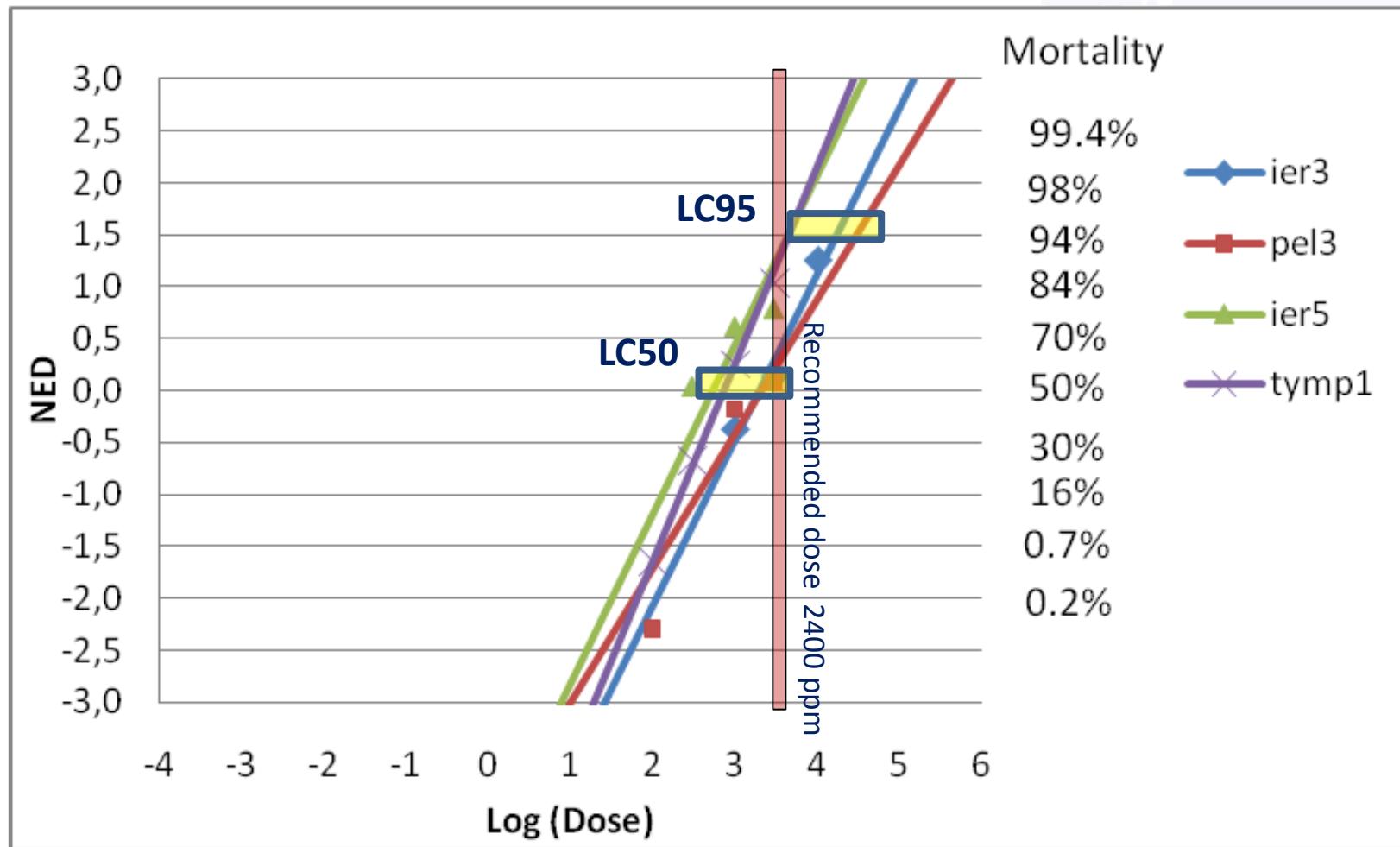
X^2 = No statistical difference ($P<0.05$)

LC50 : 31.8 – 158 (x5)

LC95 : 1847 – 4584

Recommended dose : *240 ppm*

Results : chlorpyriphos

N=4
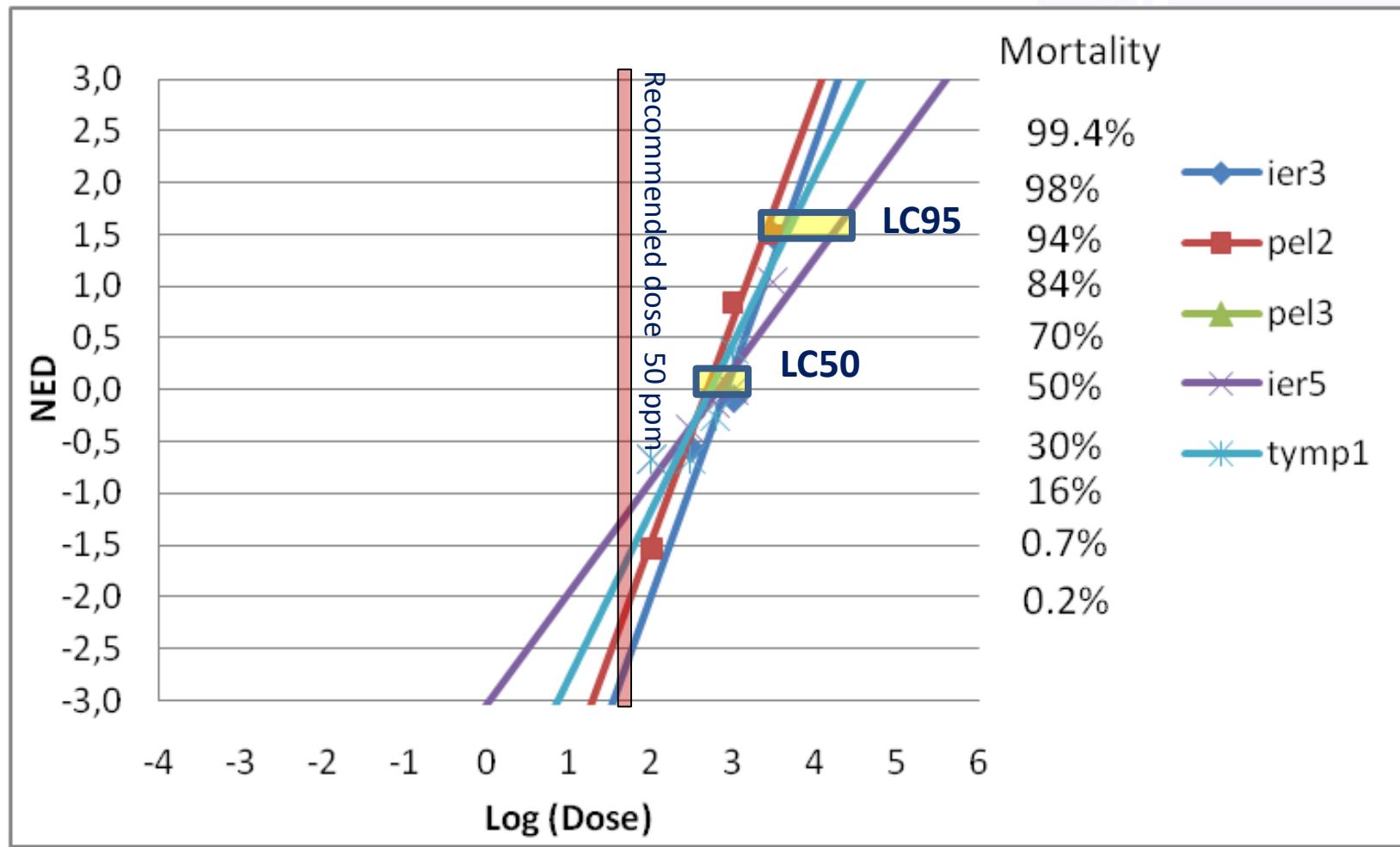
X^2 = No statistical difference (P<0.05)

LC50 : 530 – 2046 (x4)

LC95 : 5400 – 39300

Recommended dose : *2400 ppm*

Results : cypermethrin


N=6

X^2 = No statistical difference ($P<0.05$)

LC50 : 475 – 747 (x2)

LC95 : 2700 – 5400

Recommended dose : *50 ppm*

Are the registered insecticides effective against *Tuta absoluta*?

Trade name	Active ingredient	Larvicide activity	
ALTACOR 35 WG	clorantraniliprole / Rynaxypyr®	**High toxicity**	Recommended dose > LC95
BELT 24 WG	flubendiamide		
AFFIRM 095 SG	emamectin benzoate		
LASER 480 SC	spinosad		
STEWARD 30 WG	indoxacarb		
ALVERDE 24 SC	metaflumizone	**Moderate toxicity**	LC95> Recommended dose > LC50
PYRINEX 25 CS	chlorpyriphos		
ASSIST 10EC	cypermethrin	**Low Toxicity**	LC50> Recommended dose

Are the registered insecticides effective against *Tuta absoluta*?

Trade name	Active ingredient	Larvicide activity	Ovicide activity	Adulticide activity
ALTACOR 35 WG	clorantraniliprole / Rynaxypyr®	**High toxicity**	**Unknown toxicity**	**Unknown toxicity**
BELT 24 WG	flubendiamide			
AFFIRM 095 SG	emamectin benzoate			
LASER 480 SC	spinosad			
STEWARD 30 WG	indoxacarb			
ALVERDE 24 SC	metaflumizone	**Moderate toxicity**		
PYRINEX 25 CS	chlorpyriphos			
ASSIST 10EC	cypermethrin	**Low Toxicity**		

Summarising

The baseline toxicity of registered insecticides to *T. absoluta* was determined

The results were discussed in relation to the recommended application rate

Two registered insecticides were rated with 'moderate' larvicide activity against *T. absoluta*

Additional studies are required in order to acquire a complete toxicological profile of all registered products

Concluding remarks

This study highlighted **…**

> **The importance** of evaluating the efficacy of plant protection products against invading quarantine pests

> **The role** of such studies in the appropriate guidance of farmers and agronomists

Proposal

Evaluation the insecticide efficacy at National level
(low cost action, easy to perform)

Coordinated action among Nations at regional level in producing comparable results
(no cost action)

Coordinated monitoring of insecticide efficacy

A complete overview

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Thank you for your attention

Σας ευχαριστώ!

Merci pour votre attention

Gracias por su atención

أشكركم على اهتمامكم

Ilginiz için teşekkür ederiz

Dankie vir u aandag

Grazie per l'attenzione

תודה על תשומת הלב שלך

Vielen Dank für
Ihre Aufmerksamkeit