

Monitoring of Whitefly Susceptibility to Neonicotinoid Insecticides in Almeria using Imidacloprid as an Example

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CONFIDOR - The major whitefly material used in Almeria

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Almeria 2000

April 2000

Active ingredient



The cotton whitefly, *Bemisia tabaci*



Some features

- Highly active
- Prevents virus spread
- Application in irrigation water & foliar
- Good residual effect

Monitoring in a resistance hotspot

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Imidacloprid was introduced to the Spanish market in 1992

- which effectively prevents TLC-virus spread
- **but** with high resistance risk due to extensive use

- therefore Bayer conducted monitoring of whitefly susceptibility especially in Almeria

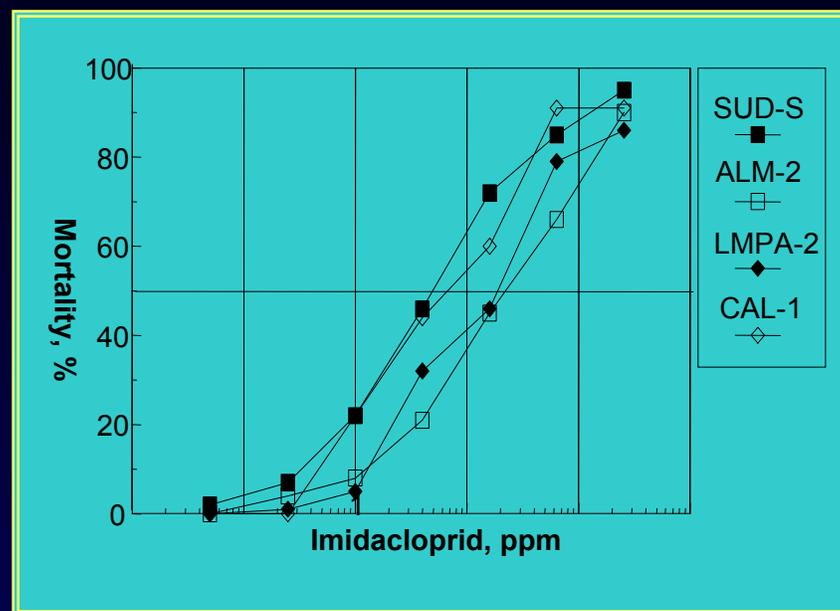
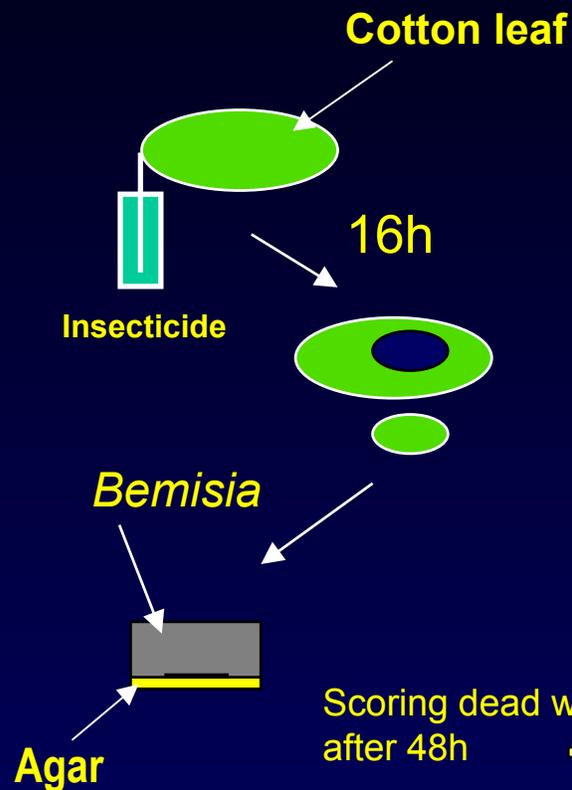
- IACR Rothamsted/UK has been approached already in 1994 as a collaborating partner in order to monitor and understand resistance development to neonicotinoid insecticides in southern Spain.

Systemic bioassay for monitoring purposes

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Scoring dead whiteflies after 48h

Log-dose probit-mortality relationship

Worldwide baseline susceptibility study (1994-96)

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Systemic bioassay

Whitefly strains from:

- Pakistan
- Spain
- Israel
- Belize
- Netherlands
- USA



Composite LC₅₀-value

1.7 ppm

Discriminating concentration chosen: 16 ppm

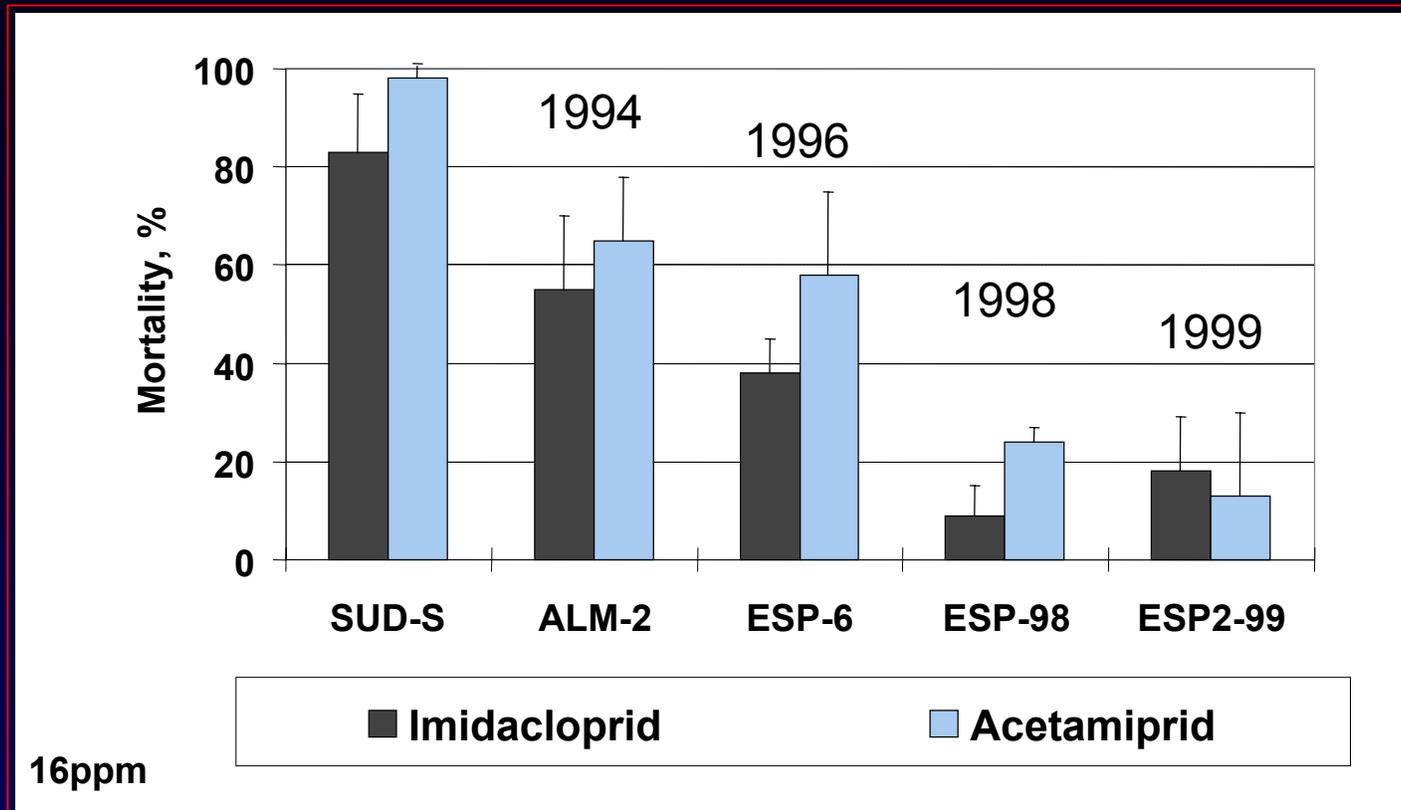
According to Cahill et al. (1996) *Bull. Ent. Res.* 86, 343

Neonicotinoid monitoring data in *B. tabaci* from Almeria

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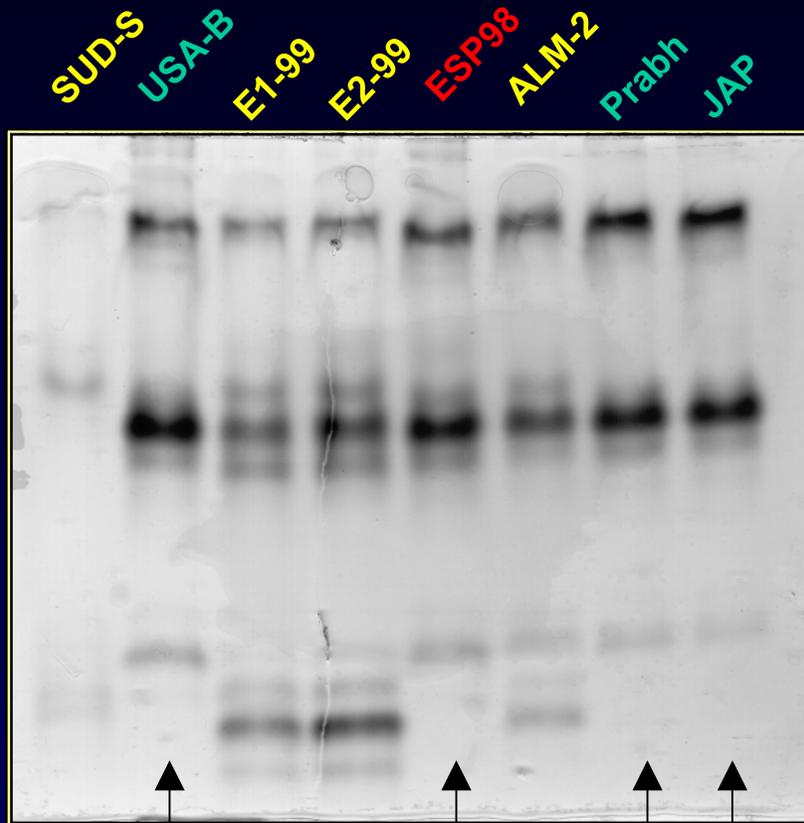
Monitoring data not correlated to field efficacy!

Loss of neonicotinoid resistance in a Spanish whitefly strain maintained in the laboratory

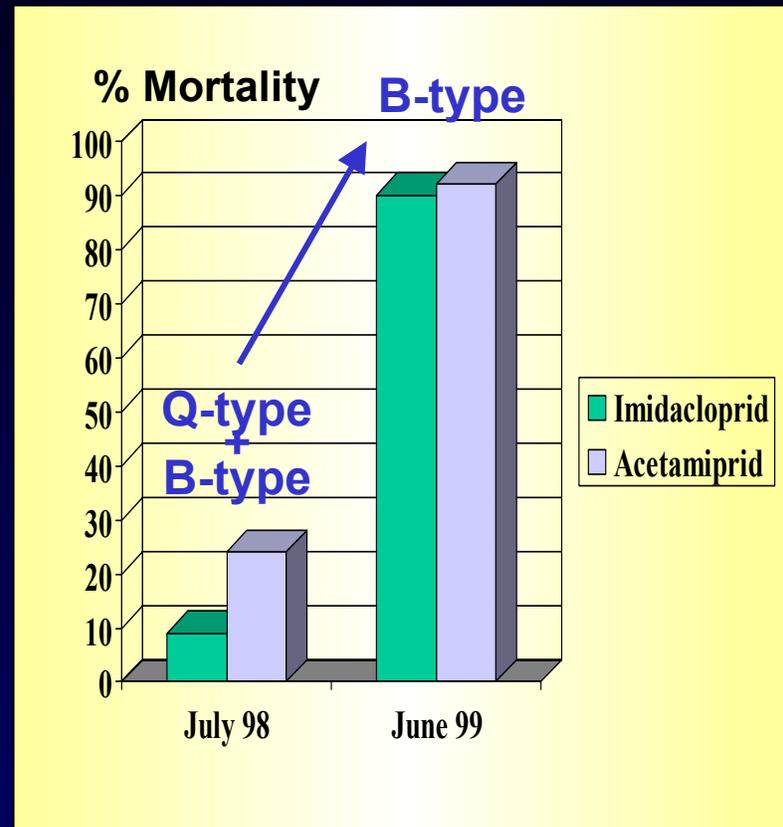
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systemic bioassay 16ppm



Biochemistry of neonicotinoid resistance

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Identification of biochemical markers

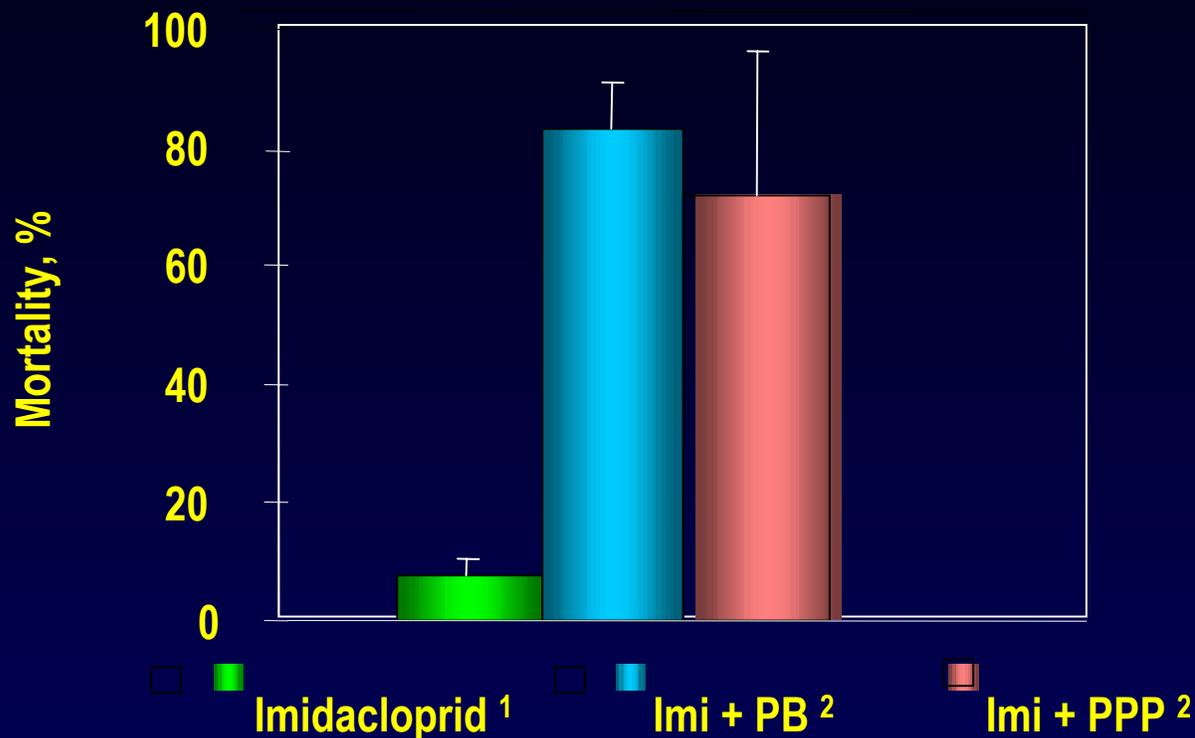
- Esterases
- Glutathione S-Transferases
- **Cytochrome P-450 systems**
- Reductive metabolism
- **Receptor insensitivity**

Effects of inhibitors of oxidative degradation

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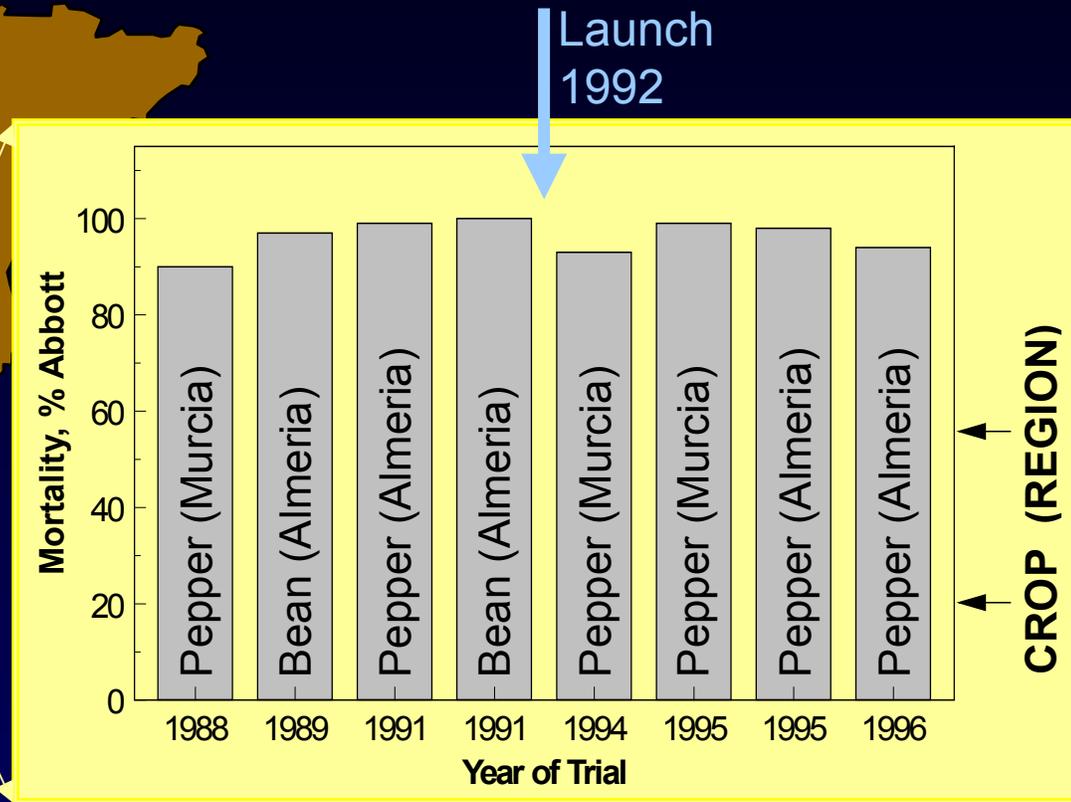
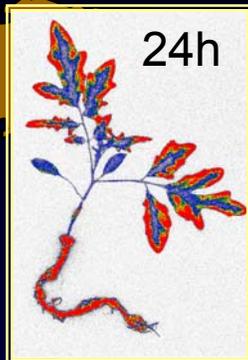
16ppm¹, 1000ppm² pretreatment 2d prior to transfer of whiteflies to imidacloprid-treated leaf discs

CONFIDOR - Field performance from 1988 - 1996

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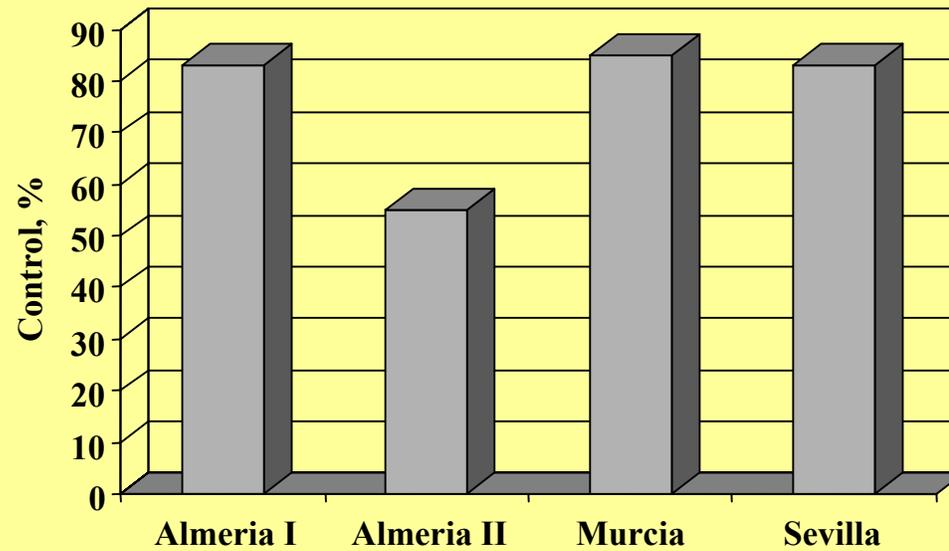
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Field results in 1998

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imidacloprid 0.1g ai/l, 2 appl.

Susceptibility of Almeria whiteflies to insecticides

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Insecticide (200ppm)	SUD-S	ALM-2	ESP-98	
Cyfluthrin	95 ± 1	95 ± 5	52 ± 4	
Endosulfan	100	85 ± 4	30 ± 10	
Monocrotophos	100	42 ± 9	15 ± 3	
Methamidophos	100	48 ± 2	25 ± 5	
Pymetrozine ¹	100	68 ± 2	17 ± 6	
Pyriproxyfen*	100	100	100	←
Imidacloprid	100	90 ± 3	72 ± 6	←
Pyridaben	97 ± 3	n.d.	75 ± 5	←
Chlorfenapyr	95 ± 5	68 ± 2	88 ± 7	←
Buprofezin*	93 ± 4	99 ± 1	68 ± 7	←

¹ 72h

adult/egg* leaf-dip bioassay

Results and conclusions

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- Monitoring of Almeria whitefly populations since 1994
- Good performance of imidacloprid confirmed but resistance development in single farms found
- Mechanism of neonicotinoid resistance under evaluation, probably metabolic
- Insecticides less or not affected by resistant Almeria field population
ESP 98:
buprofezin, chlorfenapyr, imidacloprid, pyridaben and pyriproxyfen