

SESSION VI

SIDE EFFECTS OF PESTICIDES ON NATURAL
ENEMIES

Testing for non-target effects of some fungicides and insecticides on western flower thrips and its predator *Amblyseius swirskii* under plastic tunnel conditions

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The compatibility of four pesticides (chlorantraniliprole, pymetrozine, trifloxystrobin and myclobutanil) used with the predatory mite, *Amblyseius swirskii* (Acari: Phytoseiidae) released to control western flower thrips, *Frankliniella occidentalis* (Thysanoptera: Thripidae), was investigated on peppers in plastic tunnels. One release of predatory mites from the stock culture was preventively done when the peppers started to flower at the rate of 50 adults per m². Tested pesticides were sprayed when needed. Western flower thrips populations were sampled weekly. Our results indicate that the application of tested pesticides had no effect on the ability of the predator to reduce thrips population. Thrips populations in the no-predator treatment continued to expand during the experiment, while those in the predator release treatment declined. We conclude that *A. swirskii* can be used in conjunction with the tested pesticides on pepper greenhouse without causing obvious detrimental effects to this predator and a reduction in biological control.

Insecticides and beneficial predators: side effects on *Orius* spp. on IPM pepper and strawberries

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The species of the genus *Orius* (Heteroptera: Anthocoridae) are well-known as generalist predators able to control thrips outbreaks on different crops, such as pepper and strawberries. The assessment of the compatibility of various insecticides with predatory activity is a key for the success of IPM strategies, including *Orius* releases on crops. During 2011, experiments were carried out in Piedmont (northwestern Italy) on four commercial pepper and strawberry tunnels. Toxicity of the most used insecticides were also evaluated in laboratory bioassays on wild *Orius* spp. Abamectin, λ -cyhalothrin, and acrinahtrin proved to be not compatible with these predators, both in field and laboratory experiments. Azadirachtin was almost harmless for *Orius* spp. whereas spinosad induced high levels of mortality in laboratory bioassays but seemed to be safe in field experiments. Etofenprox gave contradictory results in the field and laboratory experiments, corroborating the need of multiple testing methods in evaluating the effects of pesticides on beneficial insects.

Influence of insecticide persistence on the survival of the two braconid parasitoids *Chelonus inanitus* and *Aphidius ervi*

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An extended laboratory bioassay was conducted to evaluate the toxicity and the duration of the harmful activity of some modern insecticides and the standard deltamethrin to the braconids *Aphidius ervi* (aphid parasitoid) and *Chelonus inanitus* (*Spodoptera* egg parasitoid). Adults were initially exposed to fresh residues on tomato leaves for three days, and later on, to aged residues in greenhouse. Fresh residues of flonicamid, flubendiamide and spirotetramat were harmless to both parasitoids. Metaflumizone, however, was classified as moderately persistent for *C. inanitus* (IOBC C) and persistent for *A. ervi* (IOBC D), due to the reduction on the life span. Deltamethrin was slightly persistent (IOBC, B) and persistent, (IOBC, D) respectively, for the two natural enemies.

Side effects of bioinsecticides used to control *Tuta absoluta*

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Integrated Pest Management (IPM) programs may include pesticide applications, therefore assessing their potential side effects on biocontrol agents is of primary importance for implementing IPM. *Bracon nigricans* (Hymenoptera: Braconidae) is a larval ectoparasitoid of Lepidoptera species which was recovered on the South American tomato pinworm, *Tuta absoluta* (Lepidoptera: Gelechiidae), in various Western Palaeartic countries and is a potential biocontrol agent of this pest. We assessed acute toxicity and sublethal effect on fertility of six bioinsecticides, used for controlling *T. absoluta*, on *B. nigricans*. The tested chemicals were abamectin, azadirachtin, borax salt plus citrus essential oil, *Bacillus thuringiensis* var. *kurstaki*, emamectin benzoate and spinosad. The wasps were exposed for three days to dried pesticide residues on tomato sprouts, at two time intervals after initial treatment. Mortality was daily checked and the number of adult parasitoids emerged was recorded to assess the effects on reproduction. These data were used to calculate reduction coefficients and the pesticides were classified according to the IOBC toxicity categories. The obtained data were then discussed with the results of a previous study, conducted with the same experimental setting, on the generalist predator *Orius laevigatus* (Heteroptera: Anthocoridae). The insecticides greatly differed in their toxicity as well as in their persistence and the effects varied also between the two biocontrol agents. Our findings would help to optimize future use of the tested insecticides in IPM and organic farming, notably by preventing the possible side effects of the tested pesticides on biological control agents, both naturally present and artificially released. Furthermore, these results stress the need to carefully select the chemicals for efficient IPM programs on tomato crops.

Chlorantraniliprole (Rynaxypyr[®], Coragen[®], Altacor[®]) key features for sustainable control of *Tuta absoluta*

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Chlorantraniliprole (Rynaxypyr[®]) is a novel diamide insecticide by DuPont with outstanding performance on *Tuta absoluta* and an extremely low mammalian toxicity profile. Tested on *T. absoluta* since 2002 in Brazil at the DuPont R&D Station in Paulinia, early results indicated a new standard of *T. absoluta* control, even on insecticide-resistant populations. Since 2007 numerous field and laboratory studies have been carried out in the Mediterranean region by DuPont and independent researchers. These studies have contributed to in-depth knowledge of its features and to finalize the recommendations for use in an European IPM context. This review provides a selection of field and laboratory observations relative to the product selectivity to key natural enemies and the baseline sensitivity of *T. absoluta* populations from the Mediterranean countries and the product best use strategy for IRM (Insecticide Resistance Management).

Advantages of ecological management of leafminers (Diptera: Agromyzidae) in commercial cultivation of crisphead lettuce in southern Brazil

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The objective of this work was to evaluate the potential interference of two types of management of leafminer populations and their parasitoids under a commercial production of lettuce in plastic tunnels in the state of Minas Gerais, South-East Brazil. The comparison between conventional management using calendar sprays of insecticides, and ecological management, with *Bacillus thuringiensis*, sticky traps and pheromones, showed that ecological management has several advantages over chemical control. In the plastic tunnel with ecological management lower numbers of leafminers emerged, a greater number of parasitoids emerged, the control costs were lower and the commercial value was equivalent to the conventionally managed crop.

Field effect of different new insecticides on settled populations of *Amblyseius swirskii* (Acari: Phytoseiidae) under plastic greenhouse cucumber crop, in Almería (Spain)

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The horticultural area of Almeria and the coast of Granada is the main horticultural area for winter and early spring production in the European Union. Most of the crops are under IPM programs. This season (2011-2012) more than 22.000 hectares (more than 70% of the whole growing area) are under IPM programs. In those programs, *Amblyseius swirskii* (Acari: Phytoseiidae) is one of the most important predators used. Cucumber crop is the third crop, according with its economic importance, and actually the last frontier for IPM programs. Most of the farmers are reluctant to use IPM programs, because several insect pests (mainly scales, aphids and thrips) attack the crop, some insecticides have to be sprayed, and they may affect the main predator used in this crop (*A. swirskii*). In this work, we carried out a trial under field conditions, to determine the side effects of several new insecticides (emamectin benzoate, spirotetramat, sulfoxaflor and metaflumizone) against an installed population of *A. swirskii*, in a cucumber greenhouse crop.

Biological control of the spider mite *Tetranychus urticae* and interaction between beneficial organisms on vegetable crops in greenhouses

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Tetranychus urticae is the most important pest on vegetable crops in greenhouses in Poland and successful control of this pest is very difficult. The present registration requirement for biological control agents in Poland states that macro-organisms such as nematodes and beneficial organisms do not need to be registered. As a result, a lot of new natural enemies are now commercially available and nine species can be used against spider mites.

Research work was conducted on the interaction between natural enemies introduced into greenhouse-grown tomato crops to reduce the number of pests such as spider mites and the side effects of insecticides and fungicides on predators. This interaction was studied with reference to the predatory mite species: *Amblyseius swirskii* and *Phytoseiulus persimilis* which are used in laboratory and greenhouse tests to control the two-spotted spider mite *T. urticae*. The greatest efficacy (86%) in limiting the number of *T. urticae* was obtained through the use of *P. persimilis* and *A. swirskii*. The results of this experimental treatment were statistically different from other treatments involving both the separate and combined use of specific predatory mite species. The study also revealed competition between the two species *A. swirskii* and *P. persimilis*, with the predatory mite *A. swirskii* being the dominant species.

The insecticides Abarex, Spin Tor and Nissorun were safe for use with predatory mites and could be recommended for IPM (Integrated Pest Management) programmes for greenhouse-grown crops. The result of the studies carried out revealed that the species *P. persimilis* was the most susceptible to the different fungicides used, based on laboratory experiments, and especially when the predator was released 1 and 3 days after applying these fungicide treatments. In general, the fungicides applied showed a lower level of toxicity to all the beneficial organisms when the predatory mites were released 5 days after its application. The fungicide Topsin 500 SC appeared to be selective with respect to the species *A. swirskii*.