ECOLETTER

Regular publication of trials testing the effectiveness and properties of the products of Futureco Bioscience.

#9 07.02.2014. Compatibility tests of the agrobiological insecticide NOFLY with natural enemies.

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Introduction

The bio- insecticide NOFLY WP, whose active ingredient is based on spores of the entomopathogenic fungus *Isaria fumosoroseus* (formerly *Paecilomyces fumosoroseus*) strain FE9901, has a range of action that includes sucking insects such as whitefly *Trialeurodes vaporariorum*, *Bemisia tabaci*, *Aleurodicus dispersus* and *Lecanoideus floccissimus*, thrips and aphids. NOFLY is applied to prevent and control pests affecting solanaceous crops (tomato and pepper), cucurbits and ornamentals.

In this Ecoletter some tests results are collected to show that NOFLY is harmless to the natural enemies of agricultural pests. It was previously demonstrated that NOFLY supports both conventional insecticides and pesticides such as biological fungicides. Reducing insect pest populations and the possibility of combining both natural enemies and plant protection chemicals makes NOFLY an ideal product to be included in programs of Integrated Pest Management (IPM), resulting in a better quality of the crop for the farmer.

Materials and Methods

Trials were performed according to the guidelines of the IOBC/OILB (OPPTS 885.4530, OPPTS 885.001) to evaluate the effects of the application of plant protection products on non-target arthropods, following GLP/GEP rules and under laboratory conditions on the species: *Encarsia formosa*, *Eretmocerus mundus*, *Amblyseius swirskii*, *Orius laevigatus* and *Macrolophus calignousus* and of semi-field conditions for the species *Orius laevigatus* and *Macrolophus calignousus*.

Results

Table 1. Effect of NOFLY on the parasitoids *Encarsia formosa* and *Eretmocerus mundus*.

Species	Product	% Mortality	% Corrected Mortality	% Parasitism reduction
Encarsia formosa	Control (C)	3,8 ± 2,39 a	-	-
	Cipermethrin	77,5 ± 3,73 b	-	58,7 ± 1,88 a
	Nofly	0,0 ± 0,0 a	-3,95 ± 1,01	11,4 ± 4,71 b
Eretmocerus mundus	Control (C)	11,3 ± 3,15 a	-	-
	Deltamethrin	52,5 ± 5,53 b	-	74,7 ± 4,38 a
	Nofly	16,3 ± 4,27 a	5,6 ± 3,87	41,7 ± 6,09 b

Table 2. Effect of NOFLY on the predator *Amblyseius swirskii*.

Parameter	Product	Day 1		Day 3		Day 7	
% Eclosion	Control (C)	40 ± 5,5 a		50 ± 10,5 a		50 ± 9,0 a	
	Dimethoate	0 ± 0 b		0 ± 0 b		0 ± 0 b	
	Nofly	25 ± 0 c		50 ± 0 a		50 ± 0 a	
% Mortality	Product	Nimfs	Adults	Nimfs	Adults	Nimfs	Adults
	Control (C)	0 ± 0a	2,5 ± 2,5a	0 ± 0a	5 ± 3,5a	2,5 ± 1,5a	5 ± 3,5a
	Dimethoate	41,5 ± 8,5b	61,5 ± 14b	79 ± 4,0b	90 ± 4,5b	100 ± 0b	90 ± 4,5b
	Nofly	1,5±1,5a	0 ± 0a	1,5 ± 1,5 a	2,5 ± 2a	2,5 ± 2,5a	2,5 ± 2 a

Table 3. Effect of NOFLY on the parasitoid *Orius laevigatus*.

	% Mortality in adults					
Time	Day 2		Day 7		Day 9	
Stage	N_1	N_4	N_1	N_4	N_1	N_4
Control (C)	6,9±1,39a	0±0a	13,9±1,39a	6,9±2.78a	16,7±4,17a	8,3 ± 2,41a
Deltamethrin	95,8±4,17b	36,1±6,94b	100 ±0b	91,7±2,41b	100 ± 0b	95,8± 2,4b
Atominal 10 EC	9,37±1,39ac	0±0a	23,6±5,01a	9,7±1,39a	31,9±8,45a	19,4± 9,11a
Nofly	16,7 ±2,41a	0±0a	98,6±1,39b	45,8±6,36b	100 ± 0b	75 ± 8,67b

% M corrected N1: 100% , N4: 73,2%

Fig 1. Pest or target organisms on which NOFLY is effective. By order up to down and left to right: Larvae of Bemisia tabaci, adult whitefly, larva of aphid, aphid and thrip.

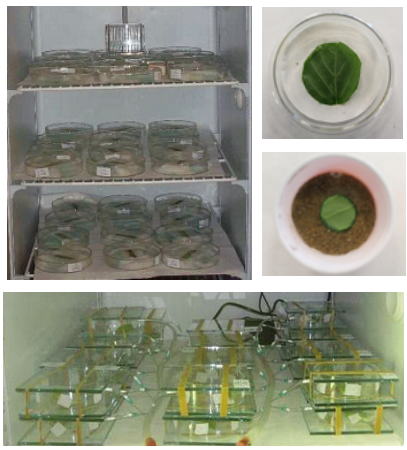

Fig 2. Compatibility tests on natural enemies in lab conditions.

Fig 3. Compatibility tests in semi-field conditions: Orius laevigatus and Macrolophus calignousus

Fig 4. Commercial product NOFLY WP

This trials were performed by standarized and official laboratories for the registration of bioinsecticides and its commercialization in the European Union.

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Table 4. Effect of NOFLY on the parasitoid *Macrolophus caliginosus*.

	% Mortality in adults					
Time	Day 2		Day 7		Day 9	
Stage	N_1	N_4	N_1	N_4	N_1	N_4
Control (C)	1,4±1,39a	1,4±1,39a	8,3±2,41a	6,9±2.78a	13,9±1,39a	4,2 ± 2,41a
Deltametrin	33,3±8,67b	2,8±2,78a	44,4 ±7,35b	91,7±2,41a	55,6± 7,35b	2 ± 1,33a
Atominal 10 EC	6,9±2,78ab	0±0a	11,1±2,78a	9,7±1,39a	20,8± 0c	4,2 ± 2,41a
Nofly	4,2 ±2,41a	0±0a	40,3±5,01b	45,8±6,36b	75 ± 2,41d	94,4± 3,67b

% M corrected N1: 70,9% , N4: 94,1%

Table 5. Effect of NOFLY on the parasitoids *Orius laevigatus* and *Macrolophus caliginosus*.

	% Mortality in adults			
Species	Product	Day 1	Day 2	Day 7
Orius laevigatus	Control (C)	0 ± 0a	5 ± 2a	5 ± 2a
	Dimetoato	58 ± 6b	62 ± 7b	65 ± 6b
	Nofly	0 ± 0a	5 ± 3a	7 ± 4a
Macrolophus caliginosus	Control (C)	3 ± 2a	8 ± 4a	15 ± 4a
	Dimetoato	65 ± 6b	65 ± 6b	65 ± 6b
	Nofly	2 ± 2a	5 ± 3a	10 ± 4a

Table 6. Resume of the compatibility of NOFLY with natural enemies.

Species	Stage	Test conditions	Notes
Encarsia formosa	Adults	Laboratory	Harmless
Eretmocerus mundus	Adults	Laboratory	Harmless
Macrolophus caliginosus	Larva N1	Laboratory	Slightly toxic
	Larva N4	Laboratory	Toxic
	Adults	Semi-field	Harmless
Orius laevigatus	Larva N1	Laboratory	Toxic
	Larva N4	Laboratory	Slightly toxic
	Adults	Semi-field	Harmless
Amblyseius swirskii	Eggs	Laboratory	Harmless
	Larvae	Laboratory	Harmless
	Adults	Laboratory	Harmless

NOFLY was totally safe under laboratory conditions (worse case scenario) when evaluated on *Encarsia formosa*, *Eretmocerus mundus* and *Amblyseius swiski*.

For *Macrolophus caliginosus* and *Amblyseius swirskii*, given its toxic or slightly toxic effect under laboratory conditions, exposure tests with NOFLY were subsequently performed in semi-field conditions (more realistic than laboratory conditions) resulting equally innocuous. These results agree with previous studies with this formulation (Sorribas & Ornat, 2003) that observed, under field conditions, that populations of *Macrolophus caliginosus* and *Encarsia formosa*, exposed to applications of NOFLY, did not decrease compared to the untreated controls.

The results described are consistent with the absence in the literature of cases of epidemics caused by strains of *Paecilomyces fumosoroseus* on beneficial insects.

Conclusions

No adverse effects of *Paecilomyces fumosoroseus* strain FE9901 (NOFLY WP) on non-target organisms evaluated in laboratory and semi-field conditions where observed. This bioinsectide has demonstrated a very low toxicity profile, resulting in a product entirely appropriate for Integrated Pest Management (IPM) programs to support biological control by natural enemies of whiteflies such as *Macrolophus, Encarsia formosa, Orius laevigatus, Eretmocerus mundus, Phytoseiulus persimilis* and *Amblyseius swiskii*.