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EFFECT OF A NEW NEONICOTINOID INSECTICIDE ON THE POPULATION OF BENEFICIAL ARTHROPODS IN COTTON IN BRAZIL

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Abstract

The objective of this work was to evaluate the effects of the new neonicotinoid insecticide (clothianidin) on the population of beneficial arthropods in cotton in Brazil. The arthropods evaluated were ladybug (*Cycloneda sanguinea*), spiders and bigeyed bug (*Geocoris* sp). The experiment was installed in field conditions and was conducted with Deltapine Ita-90 cultivar, using the design of randomized blocks, with 6 treatments and 4 replicates. The evaluations seeking to verify the mortality of the treatments on the population of these natural enemies in field conditions. The sampling method was plant-shaking. The results showed that the insecticide clothianidin WP, at the doses of 75 and 100 g a.i./ha and clothianidin SC, at the doses of 80 and 100 g a.i./ha caused medium percentages of mortality of the ladybug of 40% one day after the application. To the 14 days after the application, the population of ladybugs was reestablished in all the treatments. For spiders, clothianidin WP at the dose of 100 g a.i./ha caused percentages of mortality of 46%, one day after the application. Clothianidin SC and clothianidin WP at dose of 75 g a.i./ha were selective for spiders. For bigeyed bug, clothianidin WP at the doses of 75 and 100 g a.i./ha and clothianidin SC at the dose of 100 g a.i./ha caused medium percentages of mortality of the bugs of 30% until 7 days after the application. To the 14 days after the application, the population of bigeyed bug was reestablished in all the treatments. Clothianidin SC at the dose of 80 g a.i./ha was selective for the bug.

Introduction

Cotton crop is cultivated in more than seventy countries worldwide. The main purpose of cotton production is related to the need of fibers and seeds. In Brazil, after successive years of production losses, cotton shows signs that it is being recovered. Currently, cotton crop in Brazil occupies an area of approximately 849 thousand hectares. The central-west region is responsible for 50.48% of the national production of cottonseed, followed by the southeast region with 29.71% and the south with 14.24% (Richetti & Melo Filho, 1998).

The modern agriculture not more admits the use of chemical products of broad-spectrum action that usually cause undesirable effects to the agricultural ecosystem as resurgence, change of the status of secondary pests for primary, besides the impact to the environment with intoxication problems in animals and human.

The concept of IPM extols the natural enemies' use (predators, parasitoids and pathogens), supplemented with the use of insecticides selective when necessary (Croft & Brow, 1975). The indiscriminate use of chemical products in the control of pests has been provoking biological unbalance in favor of the pests, because, in most of the cases those products are incompatible with the beneficial action of predators and parasitoids (Alves José, 1993).

Papa (1997) affirmed that the constant popularization of this problem by the environmentalists has been beneficial, therefore, it motivates the researchers, farmers and the industry find means that lessen the answer of the nature to all action practiced against it.

The parasitoids, predators and pathogens maintenance that exercise biological control of pests of the cultivated plants is indispensable as factor of dynamic balance in the agricultural ecosystems. This preservation minimizes the need of the man's intervention in the control of pests. For that reason, in the development of programs of IPM, the compatibly of the use of the biological and chemical methods, has been receiving the researchers' growing attention in many parts of the world (Degrande, 1996).

Another very important practice is how to do the sampling of these beneficial arthropods inside of the crop. Soares and Busoli (1995) in experiment accomplished in cotton crop, were used of the following methods: visual sampling; knock down treatment; plant-shaking and sweep-net, verified that the best method to determine populations of the ladybug, *Cycloneda sanguinea*, *Geocoris ventralis, Scymnus* sp. and *Pseudodoris clavatus* was the plant-shaking.

Actually, the Brazilian cotton crop has been stopping being a family practice, as accomplished in the state of São Paulo and Paraná, and moved for the areas of the Brazilian "cerrado", occupying extensive areas in the states of Mato Grosso of the South, Mato Grosso, Goiás and areas in Bahia and Maranhão. This displacement associated to the use of new cultivars, more adapted to high altitudes and mainly the mechanization agricultural, but extremely susceptible to the viruses, its has been doing with that the farmers started to accomplish several applications for the control of pests, mainly for the aphid, not worrying about the population monitoring of the pest, with the selectiveness of the products and with the natural enemies' presence, provoking population unbalance inside of the crops, carting in increase of the cost of the production and reduction in the profits of the producer.

Control systems that consider aspects economical, ecological, agronomic, social and toxicological assume great importance in countries in development. The establishment of an agriculture based on these rules it will allow satisfactory productivities, with life quality and the participation possibility in competitive market.

The current technological advancements on the chemical area has provided the introduction of safer and more adequate insecticide molecules to be used on agriculture, contributing to a more rational management of pests control and safety to farmers.

Clothianidin is a new insecticide belongs to the subclass of chlorinicotinyl compounds within the neonicotinoid class of insecticides. The mode of action of the clothianidin is by the interference with the nicotinic acetylcoline receptor of the nervous system. It has quick stomach and contact activity. Its control many sucking and chewing pests. The objective of this work was to evaluate the effects of the clothianidin on the population of beneficial arthropods in cotton in Brazil.

Materials and Methods

The experiment was installed in field conditions at the Experimental Farm, belonging to the campus of Unesp of Ilha Solteira, located in the municipal district of Selvíria/MS/Brazil, during the month of February/2002. The experiment was conducted with Deltapine Ita-90 cultivar, using the design of randomized blocks, with 6 treatments and 4 replicates. Each plot was formed by 15 rows of 10m in length ($135m^2$), at the spacing of 0.9m and density of 12 plants/m. The fertilizer used at planting was NPK formula 4-18-12 + micronutrients, at the dose of 450 kg/ha, and for covering fertilization, K_2O was used at the dose of 60 kg/ha. Table 1 describes the treatments used. The application of each treatment was made just one time by foliar spray, using a volume of 300 L/ha.

The evaluations seeking to verify the influence of the treatments on the mortality of ladybug (*Cycloneda sanguinea*), spiders and bigeyed bug (*Geocoris* sp). The evaluates were made to the 0, 1, 7, 14 and 21 days after the application, being counted the number of the predators through sampling methods by plant-shaking that consisted of the agitation of the plants, in two points of each plot, on a cloth of 1 m of length, placed in the soil under the plants, where were counted the fallen insects on the cloth.

The obtained data were submitted to the analysis of the variance through the test F, comparing the averages by the test of Duncan (5%).

Results and Discussion

The analysis of the results showed that the sampling method for the monitoring the arthropods predator in the cotton crop through the plant-shaking on the cloth was efficient, because it provided the obtaining of significant numbers of arthropods in the made samplings, allowing a safe conclusion with of the results. In the evaluation of the number of adults of ladybugs, spiders and bigeyed bug in each treatment was not observed statistics difference among the treatments in the previous evaluation, indicating a uniform infestation of these predators in the area of the experiment. The insecticide clothianidin WP, at the doses of 75 and 100 g a.i./ha and clothianidin SC, at the doses of 80 and 100 g a.i./ha caused medium percentages of mortality of the ladybug of 40%, one day after the application. To the 14 days after the application, the population of ladybugs was reestablished in all the treatments. For spiders, clothianidin WP at the dose of 100 g a.i./ha caused percentages of mortality of 46%, one day after the application. Clothianidin SC and clothianidin WP at dose of 75 g a.i./ha were selective for spiders. For bigeyed bug, clothianidin WP at the doses of 75 and 100 g a.i./ha and clothianidin SC at the dose of 100 g a.i./ha caused medium percentages of mortality of the bugs of 30% until 7 days after the application. To the 14 days after the application, the population of bigeyed bug was reestablished in all the treatments. Clothianidin SC at the dose of 80 g a.i./ha was selective for the bug.

Disclaimer

Mention of a trade name, or specific equipment does not constitute a guarantee or warranty by the USDA or Brazilian government and not imply its approval to the exclusion of other products that may suitable.

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Table 1. Treatments used on experiment. Generic name, trade name, formulation and dose of the insecticides.

Generic name	Trade name e formulation	Dose (g a.i./ha)
1. Clothianidin	Focus WP	75
2. Clothianidin	Focus WP	100
3. Clothianidin	Supremo SC	80
4. Clothianidin	Supremo SC	100
5. Acetamiprid	Mospilan SP	90
6. Control	--	--

Table 2. Effect of clothianidin on the mortality of the adults of ladybug, *Cycloneda sanguinea*. Mean number of adults and mortality percentage (%M) of each treatment at 0, 1, 7, 14 and 21 days after application. Selvíria/MS. February/2002.

Treatments and dose (g a.i./ha)		Pre-evaluate adults	1 daa		7 daa		14 daa		21 daa	
			adults	%M	adults	%M	adults	%M	adults	%M
1. Clothianidin WP	75	17 a	11 b	42	19 ab	32	20 a	9	23 a	0
2. Clothianidin WP	100	12 a	10 b	47	17 b	39	19 a	14	16 a	11
3. Clothianidin SC	80	19 a	12 ab	37	22 a	21	23 a	0	19 a	0
4. Clothianidin SC	100	15 a	11 b	42	20 a	29	20 a	9	21 a	0
5. Acetamiprid SP	90	15 a	13 ab	32	17 b	39	21 a	5	19 a	0
6. Control	--	17 a	19 a	--	28 a	--	22 a	--	18 a	--

daa: days after application.
Means followed by the same letter are not significantly different (Duncan, p=0.05).

Table 3. Effect of clothianidin on the mortality of spiders. Mean number and mortality percentage (%M) of each treatment at 0, 1, 7, 14 and 21 days after application. Selvíria/MS. February/2002.

Treatments and dose		**Pre-evaluate**	**1 daa**		**7 daa**		**14 daa**		**21 daa**	
(g a.i./ha)		**Spider**	**Spider**	**%M**	**Spider**	**%M**	**Spider**	**%M**	**Spider**	**%M**
1. Clothianidin WP	75	15 a	8 ab	38	11 a	21	17 a	26	17 a	23
2. Clothianidin WP	100	17 a	7 b	46	9 b	36	15 a	34	16 a	27
3. Clothianidin SC	80	21 a	10 a	23	12 a	14	19 a	17	20 a	9
4. Clothianidin SC	100	16 a	9 a	31	11 a	21	19 a	17	18 a	18
5. Acetamiprid SP	90	12 a	9 a	31	10 a	28	18 a	22	21 a	5
6. Control	--	15 a	13 a	-	14 a	--	23 a	--	22 a	--

daa: days after application.
Means followed by the same letter are not significantly different (Duncan, p=0.05).

Table 4. Effect of clothianidin on the mortality of bigeyed bug, *Geocoris* sp. Mean number and mortality percentage (%M) of each treatment at 0, 1, 7, 14 and 21 days after application. Selvíria/MS. February/2002.

Treatments and dose		**Pre-evaluate**	**1 daa**		**7 daa**		**14 daa**		**21 daa**	
(g a.i./ha)		**Bug**	**Bug**	**%M**	**Bug**	**%M**	**Bug**	**%M**	**Bug**	**%M**
1. Clothianidin WP	75	17 a	8 ab	38	15 b	34	25 a	11	25 a	4
2. Clothianidin WP	100	11 a	7 b	46	16 b	30	20 a	29	23 a	12
3. Clothianidin SC	80	18 a	9 ab	31	18 a	22	28 a	0	25 a	4
4. Clothianidin SC	100	19 a	9 ab	31	16 b	30	24 a	14	25 a	4
5. Acetamiprid SP	90	14 a	7 b	46	15 b	34	22 a	21	27 a	0
6. Control	--	16 a	13 a	-	23 a	-	28 a	--	26 a	--

daa: days after application.
Means followed by the same letter are not significantly different (Duncan, p=0.05).