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EFFECT OF INSECTICIDES AND METHODS OF SAMPLING 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 insecticides more used in cotton crop in Brazil, on the population of the predator *Cycloneda sanguinea* (ladybug), and the more appropriate sampling method to evaluate this natural enemy's presence in the cotton. The experiment was installed in field conditions and was conducted with Deltapine Ita-90 cultivar, using the design of randomized blocks, with 15 treatments and 4 replicates. The evaluations seeking to verify the influence of the treatments on the population of *Cycloneda sanguinea* and the most efficient method for the sampling of this predator in field conditions. Were used the two sampling methods: plant-shaking and Knock down treatment.The results showed that the sampling method for the adults' of the ladybug count, *Cycloneda sanguinea,* through the plant-shaking was the most efficient, while the sampling method through the knock down treatment it was not shown appropriate for the ladybug adults' monitoring in cotton. In the evaluation of the number of adults of ladybugs in each treatment by the method of the plant-shaking, showed that the insecticides triflumuron, metofenosid, lufenuron and diflubenzuron (IGR), spinosad (naturalyte) and abamectin (avermectin) caused medium percentages of mortality of the ladybug inferior to 28%, while the betacyfluthrin, deltametrina and lambdacyalothrin (pyrethroids), carbosulfan (carbamate), fipronil (fenil pirazol), chrorpirifos (organophosphate) and endosulfan (ciclodien) reached mortality percentages that varied between 46 and 83%. In the final evaluation, accomplished 16 days after the application, the population of ladybugs was reestablished in all the treatments, except for the treatment with the carbosulfan that still differed significantly of the control, provoking a mortality of 40% on the ladybugs.

Introduction

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 objective of this work was to evaluate the effects of the insecticides more used in cotton crop in Brazil, on the population of the predator *Cycloneda sanguinea* (ladybug), and the more appropriate sampling method to evaluate this natural enemy's presence in the cotton.

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 months of January and February/2000. The experiment was conducted with Deltapine Ita-90 cultivar, using the design of randomized blocks, with 15 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 population of *Cycloneda sanguinea* and the most efficient method for the sampling of this predator in field conditions, were made to the 2, 5, 10 and 16 days after the application, being counted the number of adults of the predator, through two sampling methods:

1. Plant-shaking: It 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.
2. Knock down treatment: 2 cloth sheets were placed by plot, with $1.2m^2$ of area each one, under the plants of each plot. Soon after, the plants were powdered with the insecticides and dosages according to the Table 1. In the plots control it was just sprayed the areas that contained the sheets with a knock down treatment, being mixed the insecticides diclorvos and deltamethrin. After 3 hours, the sheets were retired and brought to the laboratory for the count of the fallen insects on its. To the 2, 5, 10 and 16 days after the application, the sheets were placed under the plants of each plot and these sprayed with the knock down treatment, being awaited 3 hours for the retreat of the cloth sheets, that its were brought to the laboratory for the count of the fallen insects.

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 contained in the table 2 it showed that the sampling method for the monitoring adults of the ladybug, *Cycloneda sanguinea,* in the cotton crop through the plant-shaking on the cloth was the most efficient, because it provided the obtaining of significant numbers of adults of the ladybug in the made samplings, allowing a safe conclusion with of the results. The sampling method through the knock down treatment (Table 3) it was not shown appropriate for the ladybug adults' monitoring in cotton, reaching low number of insects in the samplings, not allowing a safe evaluation of the results. Soares & Busoli (1995) tested 4 sampling methods for the count of predators, included ladybug, in the cotton crop, verifying that the method of the plant-shaking on the cloth was the most appropriate.

In the evaluation of the number of adults of ladybugs in each treatment for the method of the plant-shaking on the cloth, difference statistics was not observed among the treatments in the previous evaluation, indicating an uniform infestation of the predator in the area of the experiment. In the evaluation done 2 days after the application, it was verified that the insecticides triflumuron, metofenosid, lufenuron and diflubenzuron (IGR), fipronil (fenil pirazol), chrorpirifos (organophosphate), endosulfan (ciclodien), spinosad (naturalyte) and abamectin (avermectin) caused medium percentages of mortality of the ladybug inferior to 40%, while the betacyfluthrin, deltametrin and lambdacyalothrin (pyrethroids) and carbosulfan (carbamate) reached mortality percentages between 60 and 100%.

In the evaluations done to the 5 and 10 days after the application, it was verified that the insecticides triflumuron, metofenosid, lufenuron and diflubenzuron (IGR), spinosad (naturalyte) and abamectin (avermectin) caused medium percentages of mortality of the ladybug inferior to 28%, while the betacyfluthrin, deltametrina and lambdacyalothrin (pyrethroids), carbosulfan (carbamate), fipronil (fenil pirazol), chrorpirifos (organophosphate) and endosulfan (ciclodien) reached mortality percentages that varied between 46 and 83%. In the final evaluation, accomplished 16 days after the application, the population of ladybugs was reestablished in all the treatments, except for the treatment with the carbosulfan that still differed significantly of the control, provoking a mortality of 40% on the ladybugs.

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. Betacyfluthrin	Turbo 50 EC	7.5 g
2. Triflumuron	Alsystin 480 SC	14.4 g
3. Fipronil	Regent 800 WG	48.0 g
4. Metofenozid	Intrepid 240 SC	120.0 g
5. Spinosad	Tracer 480 SC	36.0 g
6. Lufenuron	Match 50 CE	40.0 g
7. Chlorpirifos	Sabre 450 EC	225.0 g
8. Endosulfan	Thiodan 350 EC	525.0 g
9. Abamectin	Vertimec 18 EC	9.0 g
10. Diflubenzuron	Dimilin 250 PW	15.0 g
11. Carbosulfan	Marshal 200 SC	120.0 g
12. Betacyfluthrin	Bulldock 125 SC	10.0 g
13. Deltamethrin	Decis 50 SC	10.0 g
14. Lambdacyalothrin	Karate 50 EC	15.0 g
15. Control	--	--

Table 2. Effect of insecticides on the mortality of the adults of *Cycloneda sanguinea,* evaluated by plant-shaking. Mean number of adults and mortality percentage (%M) of each treatment at 2, 5, 10 and 16 days after application. Selvíria/MS. January and February/2000.

		Pre-evaluate	2 daa		5 daa		10 daa		16 daa	
Treatments and dose (a.i./ha)		**no. adults**	**adults**	**%M**	**adults**	**%M**	**adults**	**%M**	**adults**	**%M**
1. Betacyfluthrin	7.5 g	14 a	0 c	100	3 c	83	8 bc	67	16 a	20
2. Triflumuron	14.4 g	22 a	12 b	40	15 a	17	20 a	17	22 a	0
3. Fipronil	48.0 g	24 a	12 b	40	5 c	72	8 bc	67	15 ab	25
4. Metofenozid	120.0 g	17 a	3 c	15	16 a	11	19 a	21	19 a	5
5. Spinosad	36.0 g	20 a	14 a	30	15 a	17	18 ab	25	17 a	15
6. Lufenuron	40.0 g	16 a	11 b	45	13 ab	28	21 a	12	20 a	0
7. Chlorpirifos	225.0 g	19 a	12 b	40	9 b	50	11 b	54	16 a	20
8. Endosulfan	525.0 g	22 a	14 a	30	9 b	50	13 b	46	18 a	10
9. Abamectin	9.0 g	21 a	15 a	25	13 ab	28	17 a	29	16 a	20
10. Diflubenzuron	15.0 g	15 a	15 a	25	17 a	6	22 a	8	17 a	15
11. Carbosulfan	120.0 g	18 a	8 bc	60	6 c	67	8 bc	67	12 b	40
12. Betacyfluthrin	10.0 g	28 a	0 c	100	5 c	72	6 c	75	14 ab	30
13. Deltamethrin	10.0 g	23 a	1 c	95	7 c	61	10 b	58	17 a	15
14. Lambdacyalothrin	15.0 g	24 a	1 c	95	4 c	78	8 bc	67	14 ab	30
15. Control	--	24 a	20 a	--	18 a	--	24 a	--	20	--

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

Table 3. Effect of insecticides on the mortality of the adults of *Cycloneda sanguinea,* evaluated by knock down. Mean number of adults and mortality percentage (%M) of each treatment at 2, 5, 10 and 16 days after application. Selvíria/MS. January and February/2000.

		Pre-evaluate	2 daa		5 daa		10 daa		16 daa	
Treatments and dose (a.i./ha)		**no. adults**	**adults**	**%M**	**adults**	**%M**	**adults**	**%M**	**adults**	**%M**
1. Betacyfluthrin	7.5 g	7 a	1 a	--	0 a	--	5 b	50	3	--
2. Triflumuron	14.4 g	5 a	3 a	--	3 a	--	8 a	20	6	--
3. Fipronil	48.0 g	6 a	3 a	--	1 a	--	6 a	40	3	--
4. Metofenozid	120.0 g	4 a	4 a	--	3 a	--	8 a	20	4	--
5. Spinosad	36.0 g	6 a	5 a	--	4 a	--	11 a	0	7	--
6. Lufenuron	40.0 g	8 a	5 a	--	4 a	--	8 a	20	6	--
7. Chlorpirifos	225.0 g	7 a	2 a	--	2 a	--	5 b	50	5	--
8. Endosulfan	525.0 g	6 a	2 a	--	3 a	--	5 b	50	7	--
9. Abamectin	9.0 g	7 a	3 a	--	4 a	--	6 a	40	7	--
10. Diflubenzuron	15.0 g	7 a	4 a	--	6 a	--	7 a	30	8	--
11. Carbosulfan	120.0 g	9 a	1 a	--	1 a	--	4 b	60	2	--
12. Betacyfluthrin	10.0 g	5 a	2 a	--	0 a	--	5 b	50	3	--
13. Deltamethrin	10.0 g	6 a	2 a	--	2 a	--	6 a	40	4	--
14. Lambdacyalothrin	15.0 g	8 a	1 a	--	2 a	--	5 b	50	3	--
15. Control	--	8 a	5 a	--	4 a	--	10 a	--	6	--

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