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ORIGINAL ARTICLE

Evaluation of Cyantraniliprole 10% w/v SE against insect pest complex on Pigeon pea

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ABSTRACT

New Suspo Emulsion (SE) formulation of anthranilic diamide insecticide was evaluated at Department of Entomology, MPKV, Rahuri. Four doses of cyantraniliprole 10% w/v SE along with thiamethoxam 25 % WG and chlorantraniliprole 18.5 % SC as standard checks against insect pests of pigeon pea were evaluated for bioefficacy as well as its influence on natural enemies and crop health. Nymphal and adult population of aphids, Aphis craccivora; thrips, Megalothrips usitatus; larval population of Pod borer, Helicoverpa armigera; Legume pod borer, Maruca testulalis; Pod fly, Melanogromyza obtusa was effectively controlled at 60 g a.i/ha and 70 g a.i/ha doses of cyantraniliprole 10 % w/v SE. Thiamethoxam 25 % WG found effective for the control of nymphal and adult population of Thrips, Megalothrips usitatus. Chlorantraniliprole 18.5 % SC significantly controls the larval population of Pod borer, Helicoverpa armigera; Legume pod borer, Maruca testulalis; Pod fly, Melanogromyza obtusa. Cyantraniliprole 10 % w/v SE @ 40-70 g a.i/ha found safe to natural enemies as foliar application of these treatment doses did not reduce the field population of natural enemies significantly. Also no phytotoxic adverse effect was noticed on Pigeon pea crop at 60 g a.i/ha and 120 g a.i/ha .

Key words : *Cyantraniliprole 10% w/v SE, Aphis craccivora, Megalothrips usitatus, Helicoverpa armigera, Maruca testulalis, Melanogromyza obtusa, Pigeon pea*

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INTRODUCTION

Suspo-emulsion is a formulation containing both solid and liquid active ingredients dispersed in an aqueous phase. An aqueous suspo-emulsion is a mixture of water-insoluble active ingredients dispersed in an aqueous solution, where one (or more) of the active ingredients is in suspension form and one (or more) of the active ingredients is in emulsion form. The formulation is intended for dilution into water prior to spray application. Mixtures of active ingredients are often used to provide a broader spectrum of pest control. DuPont™ Cyazypyr™ (cyantraniliprole) insecticide is the second active ingredient in the anthranilic diamide class and the first product to control a cross-spectrum of chewing and sucking pests. Cyazypyr™ has a unique combination of features viz., cross spectrum, Fast acting, translaminar, root systemic, new mode-of-action for chewing and sucking pests, selective for beneficial arthropods and low mammalian toxicity [1].

Pigeonpea, *Cajanus cajan* (L.) Millsp. is the most important dietary component of human beings. India is the largest producer contributing more than 90 per cent of the world's production of redgram. Though the area has increased, the productivity remains almost constant. The major constraint that limits the yield of pigeonpea includes podfly and pod borer infestation along with other biotic as well as abiotic stresses which leads in substantial losses [4]. Pigeonpea is attacked by over 200 species of insects [3].

It is particularly difficult to estimate losses caused by pests as the crop has a good ability to compensate for defoliation up to 50% even if it occurs in the podding stage. On an average, 30-80% losses valued at 4000 – 5000 crores [4] occur due to insect pests.

Cyantraniliprole 10% w/v SE provides a broader spectrum pest control against chewing and sucking pests. Therefore study was carried out to test the efficacy of different doses of Cyantraniliprole 10% w/v SE, adverse effect of foliar applications on pigeonpea as well as the on Green lacewings, *Chrysoperla* carnea, the natural enemy of various insect pests on pigeonpea.

MATERIAL AND METHODS

Field experiment was laid out in Randomized Block Design (RBD) with eight treatments and three replications at Instructional farm, PGI, MPKV, Rahuri, during Rabi, 2013-2014. Each insecticidal treatment plot was of 5.40 x 4.05 m dimension with spacing 45 x 20 cm. Treatments with Cyantraniliprole 10% w/v SE @ 40, 50, 60, 70 g.a.i./ha, Thiamethoxam 25% WG (Actara) @ 25 g.a.i./ha, Chlorantraniliprole 18.5% SC (Coragen) @ 30 g.a.i./ha and Untreated Control were for the study of bioefficacy of different treatments as well as the effect of foliar applications on Green lacewings, *Chrysoperla* carnea, the natural enemy of various insect pests on pigeonpea. However, the phytotoxic effect of foliar applications on pigeonpea was carried out with Cyantraniliprole 10% w/v SE @ 60 (X), 120 (2X) g.a.i./ha and Untreated Control. Each treatment was applied two times at 10 days interval when optimum pest population reaches to its threshold. Spray application carried out by using 500 lit. water per hectare as diluents with the help of high volume hand operated knapsack sprayer with hollow cone nozzle. The observations, on survival population of Aphids, *Aphis craccivora*; Thrips, *Megalurothrips usitatus*; Pod borer, *Helicoverpa armigera* and Legume pod borer, *Maruca testulalis* on 0 day before foliar application were taken as per-count and on 3rd, 7th and 10th days after each spray as post count. Post count at last day of previous foliar spray application was treated as the pre count of next foliar spray application. Five plants were randomly selected in each insecticide treatment plot for recording observations. Aphids, *Aphis craccivora* population (nymph and adults) was recorded on three leaves (top, middle and bottom) of each randomly selected plants. In case of Thrips, *Megalurothrips usitatus,* three racemes of Pigeonpea inflorescence were randomly selected for recording observation. The population (nymph and adult) of Thrips, *Megalurothrips usitatus* was counted from one opened flower per raceme.

Also, the population of Pod borer, *Helicoverpa armigera* and Legume pod borer, *Maruca testulalis* was recorded from each randomly selected plant of pigeonpea.

Average survival population of Aphids, *Aphis craccivora*; Thrips, *Megalurothrips usitatus*; Pod borer, *Helicoverpa armigera* and Legume pod borer, *Maruca testulalis* per plant in various treatments on 0, 3rd, 7th and 10th days was worked out in square root transformation for statistical analysis.

The pod damage due to infestation of Pod fly, *Melanagromyza obtuse* was recorded by observing small hole on the pod covering it with a thin membranous structure from these randomly selected plants at 10 days after second foliar application.

Percent damage in pod was worked out and transformed to arcsine values for statistical analysis. The yield of grains was recorded from each treatment plot and worked out for one hectare.

RESULTS AND DISCUSSIONS

It is seen from Table 1 (average of two sprays), that all the insecticide treatments were found significantly effective over untreated control for the control of Aphids, *Aphis craccivora*; Thrips, *Megalurothrips usitatus*; Pod borer, *Helicoverpa armigera*; Legume pod borer, *Maruca testulalis* and Pod fly, *Melanagromyza obtusa* on pigeonpea.

a. Aphids, *Aphis craccivora*:

The treatments with Cyantraniliprole 10% w/v SE @ 70 and 60 g.a.i/ha were found equally effective for the control of Aphids, *Aphis craccivora* on pigeonpea which noted in the range of 0.33-2.37 aphids/plant as against 7.87-8.67 aphids/plant in an untreated control, during the period of two spray applications at ten days interval. (Table 1)

b. Thrips, *Megalurothrips usitatus*:

The treatments with Cyantraniliprole 10% w/v SE @ 60, 70 g.a.i/ha and Thiamethoxam 25% WG (Actara) @ 25 g.a.i/ha were found equally effective for the control of Thrips, *Megalurothrips usitatus* on pigeonpea which noted in the range of 0.70-2.47 thrips/plant in these treatments as against 8.07-9.50 thrips/plant in an untreated control. (Table 2)

c. Pod borer, *Helicoverpa armigera*:

The treatment with Chlorantraniliprole 18.5% SC (Coragen) @ 30 g.a.i./ha was found most effective for the control larval population of Pod borer, *Helicoverpa armigera* on pigeonpea which noted in the range

of 0.13-0.43 larva/plant as against 1.40-1.60 larvae/plant in an untreated control. However, this treatment was found on par with Cyantraniliprole 10% w/v SE @ 70 g.a.i/ha (0.20-0.60 larva/plant) and Cyantraniliprole 10% w/v SE @ 60 g.a.i/ha (0.30-0.63 larva/plant). (Table 3)

d. Legume pod borer, *Maruca testulalis*:

The treatment with Chlorantraniliprole 18.5% SC (Coragen) @ 30 g.a.i./ha found most effective for the control of the larval population of Legume pod borer, *Maruca testulalis* on pigeonpea which recorded in the range of 0.03-0.17 larva/plant as against 1.03-1.10 larvae/plant in an untreated control. However, this treatment was found on par with Cyantraniliprole 10% w/v SE @ 70 g.a.i/ha (0.07-0.33 larva/plant) and 60 g.a.i/ha of the same formulation (0.17-0.43 larva/plant). (Table 4)

e. Pod fly, *Melanagromyza obtusa*:

The treatment with Chlorantraniliprole 18.5% SC (Coragen) @ 30 g.a.i./ha recorded least of 9.93% pod damage due to the infestation of Pod fly, *Melanagromyza obtuse* on pigeonpea as against 19.69% pod damage in an untreated control. However, the treatments with Cyantraniliprole 10% w/v SE @ 70 g.a.i/ha and the treatment with same formulation @ 60 g.a.i/ha recorded 10.01% and 10.73% pod damage respectively, and were found at par with this treatment. (Table 5)

f. Yield:

In respect of yield of pigeonpea grains, the treatment with Cyantraniliprole 10% w/v SE @ 70 g.a.i./ha recorded highest yield of 9.54 q/ha as against 8.93 q/ha in an untreated control. Whereas, the treatment with Chlorantraniliprole 18.5% SC (Coragen) @ 30 g.a.i./ha (9.43 q/ha) and Cyantraniliprole 10% w/v SE @ 60 g.a.i./ha (9.37 q/ha) were found at par with this treatment**.** (Table 5)

Statistical analysis implies that, among the treatment doses evaluated of Cyantraniliprole 10% w/v SE, the dose in the range 60-70 g.a.i./ha was found most effective for the control of Aphids, *Aphis craccivora*; Thrips, *Megalurothrips usitatus*; Pod borer, *Helicoverpa armigera*; Legume pod borer, *Maruca testulalis* and Pod fly, *Melanagromyza obtusa* on pigeonpea and also obtaining good marketable yield of pigeonpea grains. Patel *et. al.* [2] reported two higher doses of cyantraniliprole 10% OD i.e. 90 and 105 g a.i./ha highly effective in managing the population of aphid, thrips and whitefly in cotton. Also another field experiment conducted by Yadav *et. al.* in 2012 revealed that Cyantraniliprole at the rate of 80 g a.i./ha resulted in highest leaf damage reduction and was at par with cyantraniliprole at the rate of 70 g a.i./ha and thiamethoxam and spinosad. They also observed that in case of *S. litura,* Cyantraniliprole at the rate of 0.5, 0.6 and 0.7 ml/L water resulted in 100 percent mortality at 72 hours after exposure during laboratory bioassays. Tiwari and Stelinski [5] reported 297 fold higher contact toxicity of Cyantraniliprole against Citrus Psyllid, *D. citri* than its primary parasitoid, *Tamarixia radiate* (Hymenoptera: Eulophidae)[6].

Table 1: Bioefficacy of Cyantraniliprole 10% w/v SE against Aphids, *Aphis craccivora* on pigeonpea.

Tr. No.	Treatments	Dose		Av. survived nymphs and adults (Aphids, *Aphis craccivora*) per plant			
		g.a.i./ ha	Formulation gm or ml/ha	Precount	3 DAS	7 DAS	10 DAS
1	Cyantraniliprole 10% w/v SE	40	400	7.13 (2.75)*	3.03 (1.88)*	2.17 (1.62)*	5.80 (2.50)*
2	Cyantraniliprole 10% w/v SE	50	500	7.60 (2.85)	2.67 (1.78)	1.43 (1.38)	4.57 (2.25)
3	Cyantraniliprole 10% w/v SE	60	600	6.87 (2.71)	1.27 (1.31)	0.77 (1.11)	2.37 (1.69)
4	Cyantraniliprole 10% w/v SE	70	700	6.47 (2.64)	0.83 (1.14)	0.33 (0.91)	1.60 (1.44)
5	Thiamethoxam 25% WG (Actara)	25	100	6.73 (2.69)	1.70 (1.47)	1.20 (1.29)	3.37 (1.96)
6	Chlorantraniliprole 18.5% SC (Coragen)	30	150	8.83 (3.05)	7.37 (2.80)	7.60 (2.84)	7.63 (2.85)
7	Untreated control	-	-	7.70 (2.86)	8.67 (3.03)	8.67 (3.03)	7.87 (2.89)
			SE ±	0.08	0.09	0.12	0.09
			CD (p=0.05)	N.S.	0.27	0.37	0.27

(DAS- Days after spray, *- Square root transformed values-$\sqrt{x + 0.50}$)

Table 2: Bioefficacy of Cyantraniliprole 10% w/v SE against Thrips, *Megalurothrips usitatus* on pigeonpea.

Tr. No.	Treatments	Dose		Av. survived nymphs and adults (Thrips, *Megalurothrips usitatus*) per plant			
		g.a.i./ha	Formulation gm or ml/ha	Precount	3 DAS	7 DAS	10 DAS
1	Cyantraniliprole 10% w/v SE	40	400	7.70 (2.86)*	4.33 (2.20)*	3.90 (2.09)*	5.27 (2.40)*
2	Cyantraniliprole 10% w/v SE	50	500	6.97 (2.73)	2.43 (1.71)	1.80 (1.51)	3.23 (1.92)
3	Cyantraniliprole 10% w/v SE	60	600	6.57 (2.65)	1.50 (1.41)	0.97 (1.21)	2.47 (1.72)
4	Cyantraniliprole 10% w/v SE	70	700	6.70 (2.68)	1.20 (1.30)	0.73 (1.10)	2.27 (1.66)
5	Thiamethoxam 25% WG (Actara)	25	100	6.43 (2.63)	1.10 (1.26)	0.70 (1.09)	2.00 (1.58)
6	Chlorantraniliprole 18.5% SC (Coragen)	30	150	8.03 (2.92)	7.03 (2.74)	6.83 (2.70)	6.47 (2.64)
7	Untreated control	-	-	7.97 (2.91)	8.43 (2.99)	9.50 (3.16)	8.07 (2.93)
SE ±				0.08	0.07	0.09	0.08
CD (p=0.05)				N.S.	0.21	0.27	0.26

(DAS- Days after spray, *- Square root transformed values- $\sqrt{x + 0.50}$)

Table 3: Bioefficacy of Cyantraniliprole 10% w/v SE against Pod borer, *Helicoverpa armigera* on pigeonpea.

Tr. No.	Treatments	Dose		Av. survived larvae (Pod borer, *Helicoverpa armigera*) per plant			
		g.a.i./ha	Formulation gm or ml/ha	Precount	3 DAS	7 DAS	10 DAS
1	Cyantraniliprole 10% w/v SE	40	400	1.10 (1.26)*	0.63 (1.06)*	0.47 (0.98)*	1.00 (1.22)*
2	Cyantraniliprole 10% w/v SE	50	500	0.97 (1.21)	0.53 (1.02)	0.37 (0.93)	0.90 (1.18)
3	Cyantraniliprole 10% w/v SE	60	600	1.07 (1.25)	0.40 (0.95)	0.30 (0.89)	0.63 (1.06)
4	Cyantraniliprole 10% w/v SE	70	700	1.10 (1.26)	0.30 (0.89)	0.20 (0.84)	0.60 (1.05)
5	Thiamethoxam 25% WG (Actara)	25	100	0.90 (1.18)	1.23 (1.32)	1.13 (1.28)	1.03 (1.23)
6	Chlorantraniliprole 18.5% SC (Coragen)	30	150	0.97 (1.20)	0.23 (0.85)	0.13 (0.80)	0.43 (0.96)
7	Untreated control	-	-	1.03 (1.23)	1.47 (1.40)	1.60 (1.45)	1.40 (1.37)
SE ±				0.07	0.05	0.04	0.06
CD (p=0.05)				N.S.	0.15	0.12	0.17

(DAS- Days after spray, *- Square root transformed values- $\sqrt{x + 0.50}$)

Table 4: Bioefficacy of Cyantraniliprole 10% w/v SE against Legume pod borer, *Maruca testulalis* on pigeonpea.

Tr. No.	Treatments	Dose		Av. survived larvae (Legume pod borer, *Maruca testulalis*) (flower webbing with larva) per plant			
		g.a.i./ha	Formulation gm or ml/ha	Precount	3 DAS	7 DAS	10 DAS
1	Cyantraniliprole 10% w/v SE	40	400	0.83 (1.15)*	0.47 (0.98)*	0.40 (0.95)*	0.67 (1.08)*
2	Cyantraniliprole 10% w/v SE	50	500	1.00 (1.22)	0.47 (0.98)	0.27 (0.88)	0.63 (1.06)
3	Cyantraniliprole 10% w/v SE	60	600	0.93 (1.19)	0.37 (0.93)	0.17 (0.82)	0.43 (0.96)
4	Cyantraniliprole 10% w/v SE	70	700	0.70 (1.09)	0.23 (0.86)	0.07 (0.75)	0.33 (0.91)
5	Thiamethoxam 25% WG (Actara)	25	100	0.83 (1.15)	0.70 (1.09)	0.77 (1.12)	0.80 (1.14)
6	Chlorantraniliprole 18.5% SC (Coragen)	30	150	0.57 (1.03)	0.13 (0.79)	0.03 (0.73)	0.17 (0.81)
7	Untreated control	-	-	0.97 (1.21)	1.07 (1.25)	1.10 (1.26)	1.03 (1.23)
SE ±				0.06	0.05	0.03	0.05
CD (p=0.05)				N.S.	0.14	0.09	0.15

(DAS- Days after spray, *- Square root transformed values- $\sqrt{x + 0.50}$)

Table 5: Bioefficacy of Cyantraniliprole 10% w/v SE against Pod fly, *Melanagromyza obtusa* on pigeonpea and yield of pigeonpea.

Tr. No.	Treatments	Dose		% Pod damage (N.B.) due to the infestation of Pod fly, *Melanagromyza obtusa*	Yield (q/ha)
		g.a.i./ha	Formulation gm or ml/ha		
1	Cyantraniliprole 10% w/v SE	40	400	13.08 (21.20)**	9.10
2	Cyantraniliprole 10% w/v SE	50	500	12.15 (20.40)	9.27
3	Cyantraniliprole 10% w/v SE	60	600	10.73 (19.12)	9.37
4	Cyantraniliprole 10% w/v SE	70	700	10.01 (18.45)	9.54
5	Thiamethoxam 25% WG (Actara)	25	100	12.61 (20.81)	9.11
6	Chlorantraniliprole 18.5% SC (Coragen)	30	150	9.93 (18.36)	9.43
7	Untreated control	-	-	19.69 (26.35)	8.93
SE ±				0.35	0.07
CD (p=0.05)				1.09	0.22

(**-Arcsine transformed values)

Table 6. Observations on phytotoxicity.

Sr. No.	Treatment	Doses		Days of observation after 1st foliar spray.				
		g.a.i./ha	Formulation gm or ml/ha	1	3	5	7	10
1	Cyantraniliprole 10% w/v SE	60	600	0	0	0	0	0
2	Cyantraniliprole 10% w/v SE	120	1200	0	0	0	0	0
3	Untreated control	-	-	0	0	0	0	0

(Injury on leaf tip, vein clearing, necrosis, epinasty and hyponasty was recorded in 0 to 10 point scale)

Table 7. Effect of Cyantraniliprole 10% w/v SE on natural enemies.

Tr. No.	Treatments	Dose		Av. survival of natural enemies- Green lacewings, *Chrysoperla carnea* /5 plant on 7 days after spray
		g.a.i./ha	Formulation g or ml/ha	
1	Cyantraniliprole 10% w/v SE	40	400	2.50 (1.72)*
2	Cyantraniliprole 10% w/v SE	50	500	2.33 (1.68)
3	Cyantraniliprole 10% w/v SE	60	600	2.17 (1.62)
4	Cyantraniliprole 10% w/v SE	70	700	1.83 (1.53)
5	Thiamethoxam 25% WG (Actara)	25	100	2.00 (1.55)
6	Chlorantraniliprole 18.5% SC (Coragen)	30	150	2.17 (1.62)
7	Untreated control	-	-	3.50 (1.99)
			SE ±	0.11
			CD (p=0.05)	N.S.

(*-Square root transformed values- $\sqrt{x + 0.50}$)

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