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Bio-Efficacy and Relative Performance of Chlorpyrifos and Cypermethrin against Pod Borers Infesting Pigeon Pea.

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Abstract: *Bio-efficacy of chlorpyrifos 20 EC and cypermethrin 25EC was evaluated for two consecutive years in field trials conducted on pigeon pea crop against pod borer, Helicoverpa armigera. Using RBD, these pesticides were sprayed two times on pigeon pea crop, one at the stage of 50% flowering and another after 15 days of first spraying i.e. after the interval of two weeks. Performance of chlorpyrifos was evaluated at spray concentrations of 0.05, 0.07 and 0.1% and cypermethrin at spray concentrations of 0.0075, 0.0125 and 0.0175%. In all spray treatments, significant reduction in pod damage was noticed as compared to 20.33% in untreated plot. Although higher concentrations of of chlorpyrifos (0.1%) and cypermethrin (0.0175%) were superior to lower concentrations of chlorpyrifos i.e. 0.05, 0.07% and cypermethrin i.e. 0.0075, 0.0125%, respectively. Among the two pesticides chlorpyrifos provided better control on pod borer, H.armigera. The pod damage ranged from 7.16 to 10% and 11.49 to 17.99% with respect to spray treatments of chlorpyrifos and cypermethrin, respectively.*

Key words: *Bio-efficacy, chlorpyrifos, cypermethrin,Helicoverpaarmigera, infestation, pigeon pea, pod borer,pods,*

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I. Introduction:

In the semi-arid tropics and subtropical farming systems, Pigeon pea (*Cajanus Cajan* L. Millsp.) is an important pulse crop which provides high quality vegetable protein, animal feed and firewood. [1] The yield of pigeon pea varies considerably among locations, cultivators, seasons and cropping systems. Insect pests are the greatest cause for yield variation and yield constraint in most of the areas. Over the years it is observed that the crop yields are generally hampered by many pests. [2]

On pigeon pea, more than 200 species of insects have been found feeding, although only a few of these cause significant damage to the crop. Pod borers of pigeon pea consist of gram pod borer (*H. armigera*), tur plum moth (*E.atomosa*) and tur pod fly (*M. obtusa*). Among the various insect-pests attacking this crop, *Helicoverpa armigera* (Hubner) is a cosmopolitan and highly polyphagous insect which attacks numerous crop plants of agricultural importance all over the world.[3,4] and is the major biotic constraint to increasing pigeon pea production.[5]. The productivity of this crop is much low ($558haG^{-1}$) due to high incidence of insect pests particularly *Helicoverpa armigera* causing damage to 20-57% pods in both early and late varieties, ensuring the losses in seed-yield up to 20% [6]. Chemical insecticides are generally preferred for its control due to their easy availability and applicability. In recent years, this pest has caused serious threat to agriculture due to development of resistance towards commonly used insecticides viz. Carbaryl, Quinalphos etc. [7] and towards synthetic pyrethroids [8] Keeping in mind the above facts, present investigation was carried out in order to find out the efficacy and performance of selected insecticides for management of *Helicoverpa armigera* (Hubner) in pigeon pea.

II. Material And Method:

The field experiments were conducted in Nagpur area during kharif season for consecutivetwo years i.e. 2012-13 and 2013-14, using randomized block design (RBD) in order to study the bioefficacy of chlorpyrifos (20EC) and cypermethrin(25EC) against pod borer (*H.armigera*) infesting pigeon pea. The trials were carried out in randomized block design with three replications of seven treatments. Three formulations of each pesticide were prepared and applied as presented in **Table 2**. The each treatment plot was marked with 3m × 3m, having inter replication distance of 1.2 m and 1.8m, respectively **(Fig.1)**. During June, in all the marked treatment plots the pigeon pea seed variety Asha ICPL - 87119 was sown at the spacing of 60 cm × 30 cm in both experimental seasons. All normal agricultural practices were followed for raising the crop as per

recommendation in Maharashtra as given in **Table 1.** Similar work was done onchlorpyrifos andcypermethrin.[9]

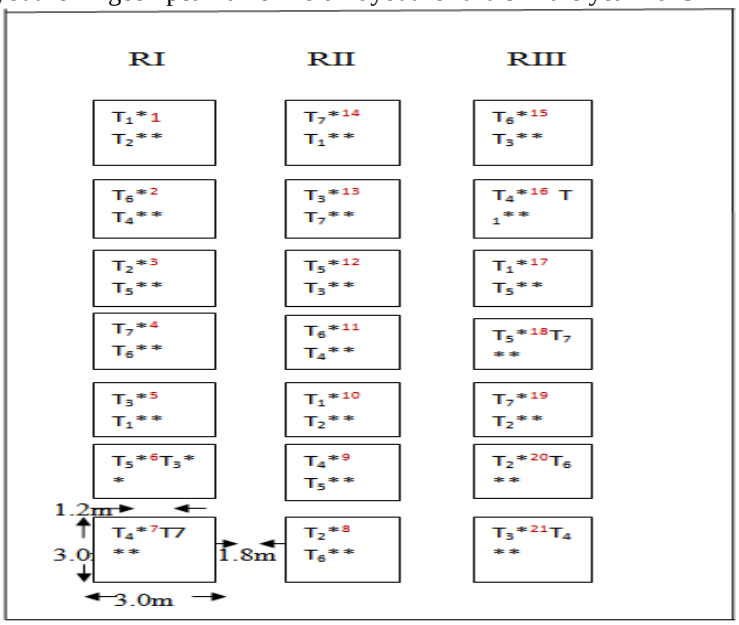
Formulated products of two selected insecticides namely, chlorpyrifos20% EC and cypermethrin 25%EC were evaluated, with three different concentrations, (0.05, 0.07, 0.1 % active ingredient and 0.0075, 0.0125, 0.0175 % active ingredient respectively. Each concentration was sprayed on pigeon pea plants in three replicated marked plots using knapsack hand operated sprayer by keeping the fluid rate of 500 L/ha. Each insecticidal treatment was applied twice at 15 days interval. The first spray was initiated at 50% flowering stage of the crop when the infestation of *H.armigera* larvae was noticed.

III. Tables and Figure

Table 1. Details Of The Field Experiment:

No.	Particulars	Pigeon pea field details
1	Plan of layout	Refer fig 1
2	Design	R.B.D.(Randomized Block Design)
3	No. of treatments	7
4	No. of replications	3
5	Total no. of plots	21
6	Plot size	3m×3m
7	Crop variety	Asha ICPL - 87119
8	Spacing	60×30cms
9	Inter-replication spacing	1.8m
10	Inter-plot spacing	1.2m
11	Total no. of plants/plot	50
12	Method of sowing	Dibbling
13	Date of sowing	
	Year 2013-14	30-06-2013
	Year2014-15	15-06-2014
14	Cultural practices (fertilizers etc.)	Recommended practices
15	No. of sprays	Two
16	Date of spraying	
	Year 2013-14	1st spray: 19 -11-2013
		2nd spray:05 -12-2013
	Year 2014-15	1st spray: 22-11-2014
		2nd spray:09-12-2014

Fig.1 Plan of Layout for Pigeon peaPlan of field Layout for trials in the year 2013-14 and year 2014-1



[*year: 2013-14 and **year: 2014-15]

TREATMENTS:

T_1: Chlorpyrifos 20EC (0.05%) T_4: Cypermethrin 25EC (0.0075%) T_7: Untreated control

T_2: Chlorpyrifos 20EC (0.07%) T_5: Cypermethrin 25EC (0.0125%)

T_3: Chlorpyrifos 20EC (0.1%) T_6: Cypermethrin 25EC (0.0175%)

Table 2. Details Of The Insecticidal Treatment Against Pod Borer (*H. Armigera*) On Pigeon Pea:

	Treatment No.	Insecticide	Concentration of insecticide (Trade product)	Concentration used in spray liquid (%)
1	T_1	Chlorpyrifos	20EC	0.05
2	T_2	Chlorpyrifos	20EC	0.07
3	T_3	Chlorpyrifos	20EC	0.1
4	T_4	Cypermethrin	25EC	0.0075
5	T_5	Cypermethrin	25EC	0.0125
6	T_6	Cypermethrin	25EC	0.0175
7	T_7	Untreated(Control)	-----	-----

On the basis of damaged pods, the effectiveness of the treatments of selected pesticides was evaluated. After harvesting, observations of pod damage due to *H. armigera* were recorded from five randomly selected plants from each replicated plots. Pods showing characteristic holes made by *H. armigera* were separated out of the total pods from five plants, counted and percent pod damage was calculated and recorded. The data on percent pod damage was further subjected to statistical analysis for comparing the treatments on the basis of critical difference.

IV. Discussion Result And:

The data on pod damage percent due to *H. armigera podborer* on pigeon pea was recorded from two years experiments for all spray treatments of chlorpyrifos (20EC) and cypermethrin (25EC) presented in **Table 3, 4**and histogram **Fig.2.**

After harvesting pigeon pea, pod damage in untreated plot was 20.33% whereas all insecticidal spray treatments were significantly superior in minimizing the pod damage which was in the range of 7.16% to 17.99%. It was also observed that in case of both pesticides with increase in the concentration, resulted in minimizing the pest infestation on pigeon pea crop. When compared the effectiveness between different treatments of chlorpyrifos and cypermethrin insecticides, it was seen that the pod damage percent in all treatments of chlorpyrifos were less than all treatments of cypermethrin after harvesting.

However, difference between 0.07 and 0.1 % spray treatment of chlorpyrifos and 0.0125 and 0.0175% spray treatment of cypermethrin were not prominent. Hence spray concentration in the range of 0.05 to 0.07 % in case of chlorpyrifos and 0.0075 to 0.0125% in case of cypermethrin can be considered more appropriate which will minimize the pesticide quantity and there will be effective control on infestation by pod borer *H.armigera* on pigeon pea.

Table 3: Pod Damage (%) percentage data based on different treatments for two years i.e. Kharif 2013-14 and 2014-15.

Treatment No.	Treatment	Pod Damage % **		
		2013-14	2014-15	Mean
T1	Chlorpyrifos (0.05% a.i.)	9.33	10.67	10.00
T2	Chlorpyrifos (0.07%a.i.)	8.66	8.33	8.49
T3	Chlorpyrifos (0.1%a.i.)	6.66	7.67	7.16
T4	Cypermethrin (0.0075%a.i.)	17.66	18.33	17.99
T5	Cypermethrin (0.0125%a.i.)	13.66	15.67	14.66
T6	Cypermethrin (0.0175%a.i.)	10.66	12.33	11.49
T7	Control	19.33	21.33	20.33

Fig. 2: Bioefficacy of Chlorpyrifos and Cypermethrin against podborer on pigeon pea.

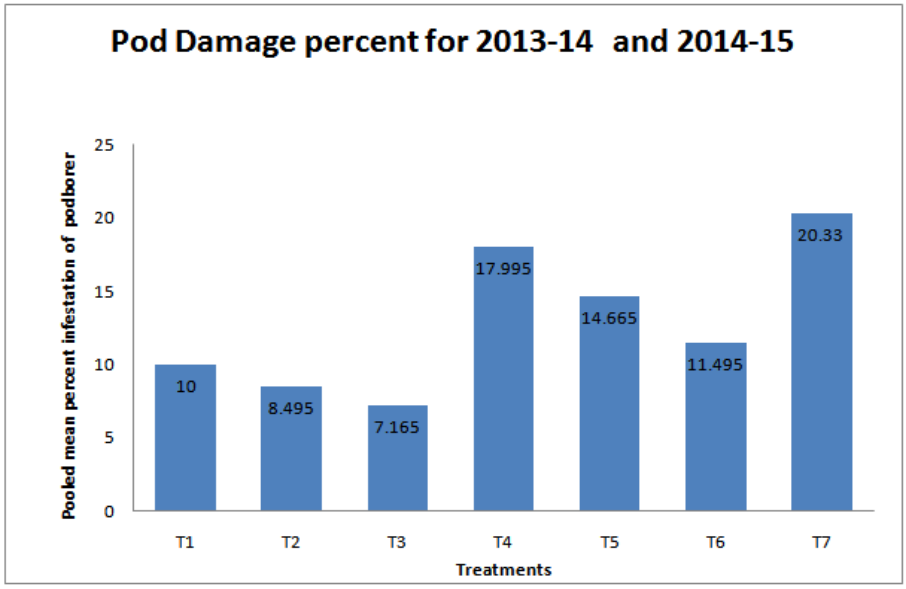


Table 4: Mean percent infestation of the pest based on two years data- Kharif 2013-14 and 2014-15

S.No.	Treatment	Insecticidal Concentration (in percent a.i.)	Arcsine Mean Per cent		Arcsine pooled mean per cent	Original Mean percent infestation
			2013-14	2014-15		
1.	T_1	Chlorpyrifos 0.05	17.79	19.07	18.43	10.00
2.	T_2	Chlorpyrifos 0.07	17.11	16.78	16.95	8.49
3.	T_3	Chlorpyrifos 0.1	14.96	16.08	15.52	7.16
4.	T_4	Cypermethrin0.0075	24.85	25.35	25.1	17.99
5.	T_5	Cypermethrin0.0125	21.69	23.32	22.5	14.66
6.	T_6	Cypermethrin0.0175	19.06	20.56	19.81	11.49
7.	T_7	Untreated control	26.08	27.51	26.8	20.33

In several studies cypermethrin was evaluated for controlling pigeon pea pests with other pyrethroids and showed low efficacy as compare to other pyrethroids. Thus,cypermethrin was found effective over the other tested pesticides. It was also noticed that cypermethrin treated plots not only had lowest damage but also lowest weight loss and highest yield. [10, 11, 12, 13, 14]. Also inseveral other investigations chlorpyrifos was evaluated for controlling pigeon pea pest with other pesticides. These studies showed that chlorpyrifos treated plots showed low pod damage and it was also found better than cypermethrin in contolling pod damage which was in support of present investigation. [15] Chlorpyrifos was also reported superior in reducing pod damage in chick pea which even increased biomass and yield. [16] On evaluation of two pesticides in present study, the performance of chlorpyrifos was superior in minimizing the pod damage by pod borer over cypermethrin.

V. Conclusion:

Keeping in view the results obtained in present investigation, two sprays of 0.05 to 0.07% of chlorpyrifos (20EC) or 0.075 to 0.0125% cypermethrin (25EC) can be advocated at an interval of 15 days, by initiating first spray at 50% flowering of pigeon pea crop for minimizing the losses caused by pigeon pea pod borer. Such pesticidal treatments should be considered risk free to the consumers.

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