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Bio-efficacy of indoxacarb 15 EC against pod borer, *Helicoverpa armigera* (Hubner) hardwick infesting pigeonpea

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ABSTRACT

Emulsifiable concentrate of indoxacarb (KN 128 15 EC) was evaluated at different doses for its field bio-efficacy in comparison with endosulfan 0.07 per cent (conventional insecticide) against *Helicoverpa armigera* (Hubner) hardwick on pigeonpea during 2003-04 and 2004-05. Different doses of indoxacarb 15 EC (KN 128) found to be more or less dose related. However, the indoxacarb 15 EC @ 50 g.a.i/ha was most effective for the control of pod borer followed by 60 g.a.i/ha. These doses also recorded significant higher grain yield during both the year (1753 and 1652 kg/ha), respectively.

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INTRODUCTION

The area, production and productivity of pigeonpea are 36.3 lakh hectares, 27.60 lakh tones and 760.33 kg./ha, respectively in India (ZPDK, 2011). Among different pulses, pigeonpea is an important pulse cum grain legume crop. The area under crop is increasing year by year due to the productivity, favourable conditions and economics of the crop. One of the major constraint in increasing productivity and good grain quality is pod borer complex. Sahoo and Senapati (2000) reported that pod borer complex found to be reduce the yield up to 27.77 per cent whereas, gram pod borer [*Helicoverpa armigera* (Hubner) hardwick] is considered to be most destructive pest. Although many chemical insecticides have been tried and recommended for the pod borers but, the use of hazardous insecticides particularly, in vegetables has to be discouraged. Hence, investigations were carried out to evaluate some of the safe materials against the pod borer complex in pigeonpea. Many of the researchers opined that sole dependence on indigenous materials/botanicals or conventional insecticides did not results in to the effective management of these pests. They also opined that scientific and judicious use of new molecules is still the best method of plant protection from the yield and economic point of view. Hence, the present study was conducted to evaluate the efficacy of newer molecule with new mode of action against pod borers.

MATERIAL AND METHODS

The pigeonpea cv. GT-100 raised after following the standard agronomical practices at Agronomy Farm, B.A. College of Agriculture, Anand Agricultural University, Anand during *Kharif* (2003-04 and 2004-05) in a plot size of 3.6×6.0 m with the spacing of 60×20 cm. The treatments were replicated four times in Randomized Block. The indoxacarb (KN 128) was evaluated @ 40, 50 and 60 g a.i./ha during 2003-04 and @ 30, 40 and 50 g a.i./ha during 2004-05. The spray application of respective treatments was given three times, first at initiation flowering, second at flowering on 50 per cent plants and third at pod setting on 50 per cent plants. Spray fluid of respective insecticide / treatment was applied (using manually operator knapsack sprayer having hollow cone nozzle at spray pressure of 35 PSI) on the crop to the extent off slight run off stage. The observations on larval population of *H. armigera* were recorded prior as well as 3, 7, and 10 days after each spray. For this purpose, 5 plants were selected randomly and tagged in each plot/replication. Three twigs (about 10 cm long) were selected randomly on each plant and counted the number of larvae after each spray. At the end, the grain yield was also recorded from net area of each plot under different treatments. The data recorded on the population of *H. armigera* and grain yield was subjected to ANOVA after following appropriate transformation. The data were also pooled over periods and years.

RESULTS AND DISCUSSION

The bio-efficacy of various insecticidal treatments has been adjudged based on larval population of *H. armigera* pooled over periods and sprays presented in Table 1 (2003-04 and 2004-05).

First year :

The data on larval population of *H. armigera* pooled

Table 1 : Effectiveness of various insecticidal treatments against *H. armigera* based on larval population over periods and sprays

Treatments	No. of larva(e) /3 twigs/plant						Pooled over Periods and sprays		Grain yield (kg/ha)	
	First year			Second year						
	First spray	Second spray	Third spray	First spray	Second spray	Third spray	First year	Second year	First year	Second year
KN 128 15 EC @ 30 g a. i /ha	-	-	-	1.53[bc]	1.78[c]	1.90[c]	-	1.74[c]	-	1012[c]
				(1.84)	(2.67)	(3.11)		(2.53)		
KN 128 15 EC @ 40 g a. i /ha	1.36[bc]	1.70[c]	1.82[c]	1.39[cd]	1.63[d]	1.78[d]	1.63[c]	1.60[d]	1202[c]	1262[b]
	(1.35)	(2.39)	(2.81)	(1.43)	(2.16)	(2.67)	(2.16)	(2.06)		
KN 128 15 EC @ 50 g a. i /ha	1.29[c]	1.41[d]	1.66[cd]	1.27[d]	1.43[e]	1.60[e]	1.45[d]	1.43[e]	1753[ab]	1652[a]
	(1.16)	(1.49)	(2.26)	(1.11)	(1.54)	(2.06)	(1.60)	(1.54)		
KN 128 15 EC @ 60 g a. i /ha	1.16[c]	1.27[d]	1.50[d]	-	-	-	1.31[d]	-	1993[a]	-
	(0.84)	(1.11)	(1.75)				(1.22)			
Endosulfan 35 EC @ 0.07 %	1.53[b]	1.98b	2.01[b]	1.68[b]	1.97[b]	2.06[b]	1.84[b]	1.90[b]	1542[bc]	1412[b]
	(1.84)	(3.42)	(3.54)	(2.32)	(3.38)	(3.74)	(2.89)	(3.11)		
Control (water spray)	1.83[a]	2.35[a]	2.42[a]	2.10[a]	2.40[a]	2.53[a]	2.20[a]	2.34[a]	541[d]	563[d]
	(2.85)	(5.02)	(5.36)	(3.91)	(5.26)	(5.90)	(4.34)	(4.98)		
S.E. ±										
Treatment (T)	0.07	0.06	0.06	0.05	0.04	0.03	0.06	0.02	133	51.81
Period (P)	0.03	0.05	0.05	0.04	0.03	0.02	0.08	0.07	-	-
Year (S)	-	-	-	-	-	-	0.01	0.01	-	-
T x P	0.2	0.11	0.1	0.08	0.07	0.05	0.05	0.04	-	-
S x P	_	-	-	-	-	-	0.03	0.02	-	-
S x T	-	-	-	-	-	-	0.05	0.04	-	-
S x P x T	-	-	-	-	-	-	0.09	0.07	-	-
C.D. (P=0.05)										
T	0.23	0.18	0.17	0.13	0.11	0.07	0.18	0.06	410.75	159.65
P	0.09	0.14	0.11	0.13	0.11	0.06	NS	0.15	-	-
S	-	-	-	-	-	-	0.04	0.04	-	-
T x P	0.2	NS	NS	NS	NS	0.05	0.15	NS	-	-
S x P	-	-	-	-	-	-	0.04	0.07	-	-
S x T	-	-	-	-	-	-	0.15	NS	-	-
S x P x T	-	-	-	-	-	-	NS	NS	-	-
C.V. (%)	9.89	12.21	10.75	10.32	7.54	4.58	10.87	7.47	18.96	8.78

Notes: NS=Non-significant;
– Figures in parentheses are retransformed values while those outside are $\sqrt{X + 0.5}$ transformed values;
– Treatment means with letter(s) in common are not significant by DNMRT at 5% level of significance

over periods revealed that all the insecticidal treatments were found significantly superior than control after each sprays. The effectiveness of indoxacarb (KN 128) found to be dose related. At all the three doses, it was found significantly more effective than endosulfan after second and third spray, but at lower dose (40 g a.i./ha) it was as effective as endosulfan 0.07 per cent after first spray. The two doses *viz.*, 50 and 60 g a.i./ ha of indoxacarb (KN 128) were at par after second and third spray (pooled over periods and sprays). The data on larval population pooled over sprays and days revealed that all the insecticidal treatments recorded significantly lower eggs population (1.22 – 2.89/3 twigs) than control (4.34/3 twigs). The insecticidal treatments also differ significantly from each other. Endosulfan 0.07 per cent found to be the least effective than indoxacarb (KN 128) at all the three doses.

Second year :

The data on larval population pooled over days and spray revealed that all the insecticidal treatments differed significantly from each other and recorded significantly lower population (1.54-3.11/3 twigs) than control (4.98/3 twigs). The toxicity of indoxacarb (KN 128) to larvae was also dose dependent as observed during the first year. Endosulfan 0.07 per cent found significantly less effective than indoxacarb (KN 128) 30 g a.i./ha, the lowest dose. Indoxacarb (KN 128) at all the three doses (30, 40 and 50 g. a.i./ha) found to be significantly superior to endosulfan 0.07 per cent. All the three doses also differed significantly from each other after second and third spray. Babariya *et al.* (2010) also reported the higher efficacy of indoxacarb 0.0075 per cent against this pest in pigeonpea. Similar type of observation to be recorded by Sunilkumar *et al.* (2009) and Ashokkumar and Shivaraju (2009) that indoxacarb was found to be effective molecule among the newer insecticide molecules evaluated against pod borers and also reducing the pod damage.

Grain yield :

During the first year, all insecticidal treatments recorded significantly higher yield (1202 – 1993 kg/ha) than control (541 kg/ha). Indoxacarb (KN 128) @ 60 g a.i./ha recorded the highest yield (1993 kg/ha) and differed significantly from rest of the treatments except indoxacarb (KN 128) @ 50 g a. i./ ha which was in turn at par with endosulfan 0.07 per cent. Indoxacarb (KN 128) @ 40 g a.i./ ha found least effective and at par with endosulfan 0.07 per cent. The same trend was also followed during second and recorded higher yield (1012-1653 kg/ha) than control (563 kg/ha). Indoxacarb @ 50 g a.i./ha found most effective and differed significantly from rest of the insecticidal treatments. Next effective treatment was endosulfan 0.07 per cent which was at par with indoxacarb (KN 128) @ 40 g a.i./ha. Rekha and Mallapur (2007) reported the highest bean pod yield of 15.14 q/ha in emamectin benzoate followed by spinosad (14.11 q/ha) and indoxacarb (13.11 q/ha) which were on par with each other. Such type of trend was also reported by Bharpoda *et al*. (2003); Cagnieul and Alin (2003); Siddegowda *et al*. (2007); Dabhi (2008); Narkhede and Singh (2012); Singh *et al*. (2013); Bhatt *et al.* (2013); Math *et al.* (2014).

The bio-efficacy of Indoxacarb 15 EC (KN 128) was found to be more or less dose related *i.e.*, with increase of dose, there was corresponding decrease in larvae population of *H. armigera* and increase in grain yield of pigeonpea. Based on results of two years (2003-04 and 2004-05), it can be concluded that Indoxacarb15 EC (KN 128) @ 50 g a.i./ha was found effective for the control of *H. armigera* in pigeonpea. Similar results were also reported by Jagadeesh Babu and Mallikarjun, 2012; Rathod *et al.*, 2014; Barad *et al.*, 2014 and Karkar *et al.*, 2014.

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