The Andhra Agric. J 62(3): 606-610, 2015

Management of Pigeonpea Pod Borer Complex with Bio Rational Insecticides

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ABSTRACT

The field experiments was under taken on "Management of pigeonpea pod borer complex with bio rational insecticides" during *Kharif* 2009 at Regional Agricultural Research Station, Lam, Guntur. Results indicated that among seven bio-rational insecticides evaluated for their efficacy against pod borer complex, treatments like *Bacillus thuringiensis* (Ber.) @ 2 ml/l (34.38%) and NSKE @ 5% (31.33%) were effective in suppressing the inflorescence damage. *Bt* @ 2ml/lt and NSKE 5% were on par with each other with least pod damage by *M. vitrata* (7.09% and 7.48%), *H. armigera* (2.94% and 2.97%) and *M. obtusa* (5.43 % and 7.31%), respectively. The chemical check chlorpyriphos + dichlorvos @ 2.5 + 1ml/ l recorded 42.96% inflorescence damage and 6.76, 2.09 and 4.25 per cent pod damage due to *M. vitrata, H. armigera* and *M. obtusa,* respectively and was significantly superior over other treatments. Higher yield was recorded in *Bt* @ 2 ml/l (999.87 Kg/ha) followed by NSKE 5% (955.53 Kg/ha) with 102.23 and 93.25 % increase over control. The highest yield was recorded by the chemical check chlorpyriphos + dichlorvos @ 2.5 + 1ml/l (1263.67 Kg/ha) with 155.58 % increase over control and significantly superior over other treatments

Key words : Biorational insecticides, *Helicoverpa armigera*, *Maruca vitrata*, *Melanagromyza obtusa*, Pigeonpea, Podborer complex.

Pigeonpea (*Cajanus cajan* (L)Millsp.,) is an important pulse crop providing high quality vegetable protein, animal feed and firewood (Shanower and Romeis,1999). India is the largest producer of pigeonpea contributing 76.5% of world production (CGIAR, 2005). In India, pigeonpea is grown in 3.5 million ha with an annual production of 2.4 million tonnes (FAO, 2005). Pigeonpea is prone to different insects which feed on flowers, pods and seeds. Among the major insect pests, gram pod borer (*Helicoverpa armigera,* Hubner*,),* spotted pod borer (*Maruca vitrata,* Geyer*)* and pod fly (*Melanagromyza obtusa,* Malloch*)* are the major constraints in pigeonpea production (Lateef and Reed 1990). The annual loss due to *M. vitrata* and *H. armigera* in pigeonpea was estimated as US$ 30 millions and US$ 400 millions worldwide (ICRISAT, 2007). Farmers are over dependent on insecticides for the control of pests since 1970's, which are no longer providing satisfactory control as the pests are developing resistance to the insecticides. Indiscriminate use of insecticides causes environmental pollution, resistance to insects and hazards to human beings. Different fungal, bacterial and entomopathogenic nematodes are known to affect the pod borers in pigeonpea ecosystem (Singh and Ali, 2005). Keeping this in view, experiments were planned

MATERIAL AND METHODS

The experiment was laid out in a simple randomized block design (RBD) with 8 treatments replicated thrice including untreated control certain treatments like *Bt* @ 2 ml/l and NSKE @ 5%, *Verticillium sp* @ 5g/l, *Metarrhizium anisopliae* @ 5g/l, *Heterosternma indica* @ 30 lakh nematodes/l, *Beauveria bassiana* @ 5g/l and *Nomuraea rileyi* @ 5g/l and the chemical check chlorpyriphos + dichlorvos @ 2.5 + 1 ml/l were selected to evaluate their efficacy against the pod borer complex of pigeonpea. The treatments were imposed at flower bud initiation stage at weekly interval. During the crop period 3 sprays were given. Each plot (30 m^2) received 1.5 lt. of spray fluid @ 200 lt /acre or 500 lt /ha.

Data Recording:

For recording the data five plants were selected randomly in each replication of the treatment leaving border rows. The observations were recorded one day before treatment as pre-treatment count and at three and five days after each spray as post-treatment counts. The data was recorded on inflorescence damage on five branches of five plants and pod damage on hundred pods from each plot were collected at the time of harvest and they were split and opened to count the healthy and damaged grains.

Depending upon the following damage symptoms the pods were separated and the per cent pod damage was calculated.

1. The spotted pod borer, *M. vitrata*:

Recorded by taking into account the irregular bored holes and webbed excreta at the entrance of the bored holes on the pod.

2. The pod fly, *M. obtusa*:

Recorded by the presence of small hole and gnawed or burrowed pod and shriveled seed in the pod.

3. The gram caterpillar, *H. armigera*:

Recorded by presence of circular big hole one or more on each pod at each seed.

Yield

Harvesting was done treatment wise when the pods were ripened. After drying for 6-7 days the pods were threshed and grains were collected plot wise. The total yield/treatment was recorded separately for assessing the influence of different treatments on yield.

The Per cent pod damage was calculated by the formula

$$\text{Per cent pod damage} = \frac{\text{Damaged pods}}{\text{Total pods}} \times 100$$

The percentage values were duly transformed into the corresponding angular values and were subjected to statistical scrutiny (Snedecor and Cochran, 1967). The per cent increase in yield over untreated control in various treatments was calculated by using the following formula.

$$\text{Percentage increase of yield in treatment over control} = \frac{\text{Yield in treatment} - \text{Yield in control}}{\text{Yield in control}} \text{ X } 100$$

RESULTS AND DISCUSSION

Efficacy of treatments on inflorescence damage

The cumulative efficacy of different insecticides on inflorescence damage observed at three and five days of three sprays at weekly interval showed that among bio-rational insecticides tested, *Bt* @ 2ml/l (34.38%) was superior over other bio-rational insecticides which agrees with the findings of Mohammed and Rao (1999), Mohapatra and Srivastava (2002) and Chandrayudu *et al*. (2008)

The next best treatment was NSKE @ 5 % with 31.33 per cent reduction over control in inflorescence damage. The present findings are in agreement with Sadawarte and Sarode (1997) and Srinivasan and Sridhar (2008) who demonstrated that the NSKE @ 5 % was found effective in reducing the larval population of *M. vitrata.*

However the chemical check chlorpyriphos+dichlorvos @ 2.5 + 1 ml/l was most effective by recording 42.96 % reduction of inflorescence damage and significantly superior over the other treatments This findings was in conformity with Lakshmi *et al.* (2002)

Efficacy of different bio-rational insecticides on pod damage

M. vitrata

Among the bio-rational insecticides *Bt* @ 2 ml/l (64.36%), NSKE @ 5% (62.93) and *Verticillium* sp (62.23%) were effective in reducing the pod damage and they were on par with each other. The chemical insecticide chlorpyriphos + dichlorvos @ 2.5 + 1 ml/l (66.50%) was significantly superior over the rest of the treatments. The present findings are in accordance with Pawar and Gunjal (1995) who demonstrated that *Bt.* preparation Wock Biological 01 (Halt) @ 1000 g/ha was found effective in controlling the lepidopteran pod borer complex by recording only 7.74% pod damage. Among the bio-rationals, *Bt* was effective in controlling *Maruca* with lowest pod damage, seed damage and seed loss to the extent of 11.66, 6.49 and 5.70 respectively (Patnaik *et al.,* 1986). Mohapatra and Srivastava (2002), Srinivasan and Sridhar (2008) demonstrated that the NSKE @ 5 % was found effective in reducing the larval population of *M. vitrata* and recorded higher yields.

Table 1. Efficacy of different biorational insecticides against pod borer complex in pigeonpea.

S.No	Treatments	Before spray	Inflorescence damage Per cent reduction over control		
			3 DAT	5 DAT	Overall efficacy
T_1	*Heterosternma indica* @(30 lakhs nematodes/lt)	17.2 (24.50)	21.86 (27.87)[cd]	29.62 (32.97)[d]	25.74 (30.48)[e]
T_2	*Beauveria bassiana* @5g/lt (1×10^8 CFU/g)	16.73 (24.14)	21.32 (27.49)[d]	28.42 (32.21)[d]	24.87 (29.91)[f]
T_3	*Verticillium sp* @5g/lt (1×10^8 CFU/g)	16.10 (23.65)	19.38 (26.11)[d]	36.10 (37.31)[b]	28.06 (31.98)[d]
T_4	*Nomuraea rileyi* @5g/lt (1×10^8 CFU/g)	16.07 (23.63)	20.84 (27.16)[d]	23.87 (29.24)[e]	22.35 (28.21)[g]
T_5	*Metarrhizium anisopliae* @5g/l (1×10^8 CFU/g)	15.94 (23.53)	23.00 (31.02)[b]	32.01 (34.45)[c]	27.50 (31.62)[d]
T_6	*Bacillus thuringiensis* @2ml/lt	13.98 (21.95)	32.07 (28.65)[c]	36.75 (37.28)[b]	34.38 (35.89)[b]
T_7	NSKE 5%	15.91 (23.50)	26.56 (34.49)[a]	36.70 (36.93)[b]	31.33 (34.03)[c]
T_8	Check (chlorypyriphos + dichlorovos) @ 2.5 + 1ml/lt	17.65 (24.84)	32.99 (35.05)[a]	52.94 (46.68)[a]	42.96 (40.95)[a]
T_9	Untreated control	22.30 (19.73)	0	0	0
F-test			Sig	Sig	Sig
SEm±			0.314	0.38	0.28
CD(0.05)			0.94	1.15	0.86
C.V (%)			4.06	4.87	3.70

* Figures in parentheses are arcsine transformed values

Chandrayudu *et al.* (2006) reported that pod damage due to spotted pod borer in cowpea was significantly less in chlorpyriphos + DDVP treatment @ 2.5+1 ml/l.

M. obtusa

Among the bio-rational insecticides *Bt* @ 2 ml/l (71.22 %), NSKE @ 5% (61.26 %) and *B.bassiana* @ 5 ml/l (49.17 %) were effective in reducing the pod damage over untreated and they were on par with each other. The chemical insecticide chlorpyriphos + dichlorvos @ 2.5 + 1 ml/l (77.47 %) was significantly superior over rest of the treatments. The findings are in agreement with the findings of Pandao *et al.* (1992) who reported that neem seed extract 5 % was effective over control in reducing damage due to pod fly, *M. obtusa* on *rabi* pigeonpea. Pandao *et al.* (1993) reported triazophos @ 0.07% was significantly superior against *M. obtusa* pod damage and it was at par with monocrotophos @ 0.04% and neem seed kernel extract 5%.

H. armigera

Among the bio-rational insecticides, *Bt* @ 2 ml/l (74.01%), NSKE @ 5% (73.38%) and *M. anisopliae* @ 5ml/l (69.98%) were effective in reducing the pod damage over untreated and they were on par with each other. The chemical check chlorpyriphos + dichlorvos @ 2.5 + 1 ml/l (81.27%) was significantly superior over rest of the treatments. The present findings are in confirmity with the findings of Shankar *et al.* 1992 who reported that the performance of the *Bt* preparation,

Table 2. Efficacy of different biorational insecticides against pod damage due to Podborer complex in pigeonpea

Treatments	% pod damage			Yield (Kg/ha)
	M.vitrata	*M.obtusa*	*H.armigera*	
Heterosternma indica @(30 lakhs nematodes/lt)	9.07 (17.52)^{ab}	12.51 (20.70)^{c}	5.49 (13.55)^{b}	836.07
Beauveria bassiana @5g/lt (1×10^{8} CFU/g)	13.59 (21.56)^{b}	9.59 (18.04)^{bc}	8.77 (17.17)^{c}	767.10
Verticillium sp @5g/lt (1×10^{8} CFU/g)	7.62 (15.96)^{a}	11.91 (20.19)^{c}	3.78 (11.19)^{b}	908.29
Nomuraea rileyi @5g/lt (1×10^{8} CFU/g)	13.87 (21.86)^{b}	11.70 (11.70)^{a}	8.73 (17.18)^{c}	691.67
Metarrhizium anisopliae @5g/l (1×10^{8} CFU/g)	11.71 (19.76)^{b}	11.10 (19.44)^{c}	3.35 (10.41)^{ab}	955.53
Bacillus thuringiensis @2ml/lt	7.09 (15.40)^{a}	5.43 (13.22)^{ab}	2.94 (9.81)^{ab}	999.87
NSKE 5%	7.48 (15.87)^{a}	7.31 (15.51)^{b}	2.97 (9.76)^{ab}	935.77
Check (chlorypyriphos + dichlorovos) @ 2.5 + 1ml/lt	6.76 (14.96)^{a}	4.25 (11.83)^{a}	2.09 (8.30)^{a}	1263.67
Untreated control	20.18 (26.67)^{c}	18.87 (25.70)^{d}	11.16 (19.49)^{c}	494.43
	Sig	Sig	Sig	Sig
	1.16	1.00	1.01	63.60
	3.48	3.00	3.04	190.67
	10.08	9.99	8.60	12.60

* Figures in parentheses are arcsine transformed values

Biobit was effective in reducing pod and grain damage due to *H. armigera* on pigeonpea. Sadawarte and Sarode (1997) reported that the application of NSKE 5% + half dose of conventional insecticides recorded maximum larval reduction of *H. armigera.*

Mohammed and Rao (1999) concluded that *Bt* @ 0.1% was effective in controlling larvae of *H. armigera* in pigeonpea which recorded 8.2 per cent pod damage as against 14.7 per cent in untreated control.

Yield

Among the different bio-rational insecticides evaluated the maximum yield was recorded with *Bt* @ 2 ml/l (999.87 Kg/ha), NSKE @ 5% (955.53 Kg/ha) and *M. anisopliae* (935.77 Kg/ha) and they were on par with each other. The chemical check chlorpyriphos + dichlorvos @ 2.5 + 1ml/l recorded maximum yield of 1263.67 Kg/ha which is significantly superior over rest of the treatments. The present findings are in accordance with the findings of Mohammed and Rao (1999) who recorded highest yield of 1040 Kg ha^{-1} compared to 910 Kg ha^{-1} in untreated control with *Bt* @ 0.1% against larvae of *H. armigera* in pigeonpea. Ram and Rastogi (2006) reported that alternate spray of endosulfan 630 g, NPV 500 LE/ha and NSKE 32.5 Kg/ha; chlorpyriphos 390 g, NSKE 32.5 Kg/ha and endosulfan 630g; chlorpyriphos 390 g and endosulfan 630g each alone consistently and significantly reduced pod borer damage less than 27.9% with grain yield of more than 880 Kg/ha in pigeonpea.

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(Received on 21.08.2013 and revised on 21.12.2013)