The Andhra Agric. J 61(2): 366-371, 2014

Efficacy of Some Newer Insecticides against Pod Borer Complex on Pigeonpea

M Sunita Devi, G Ramachandra Rao, M Sreekanth
Department of Entmology, Agricultural College, Bapatla – 522 101

ABSTRACT

A field experiment was conducted at Regional Agricultural Research Station, Lam, Guntur during *Kharif* 2011 to evaluate the efficacy of some newer insecticides against pigeonpea pod borers, *Maruca vitrata, Helicoverpa armigera* and *Melanagromyza obtusa* on Pigeonpea. Among the treatments chlorantraniliprole (20 EC) @ 0.3 ml l^{-1} and flubendiamide (480 SC) @ 0.2 ml l^{-1} were found to be most effective against *H.armigera* and *M.vitrata* by recording highest per cent reduction in larval population, low per cent pod damage and higher yields (569.00 and 531.77 kg ha^{-1} respectively) over untreated control (291 kg ha^{-1}). *M. obtusa* was effectively controlled by dimethoate 30EC @ 2 ml L^{-1} followed by quinalphos (25 EC) @ 2 ml L^{-1}, chlorpyriphos+dichlorvos (76 EC) @ 2.5+1 ml L^{-1} and profenophos (50 EC) @ 2 ml L^{-1}.

Key words : Insecticides, *H. armigera*, *M. obtusa*, *M. vitrata,* Pigeonpea.

Pigeonpea, *Cajanus cajan* is one of the major pulse crops grown in India. In India, pigeonpea is grown in 3.5 million ha with an annual production of 2.4 million tonnes and 697 kg ha^{-1} of productivity (FAO, 2005). The productivity of Pigeonpea is low in India due to many factors of which, the attack by insect pests, particularly that of pod borers, *M. vitrata* (Geyer), *H. armigera* (Hubner) and *M. obtusa* (Malloch) is of most significance. The yield losses caused by *M. vitrata* have been estimated to be around US$ 30 million annually in India (Saxena *et al.,* 2002). *H. armigera* causes worldwide yield losses of more than US$ 400 million annually (ICRISAT, 2007). *M. obtusa* cause 80% yield loss in India (Durairaj, 1995).

The indiscriminate use of conventional insecticides has led to the development of resistance in insects. Therefore, the performance of new group of insecticides in changing Insect-Plant-Environment interaction, with specific knowledge of host plant resistance must be emphasized. Exploring newer insecticides that would leave lesser residues and pose lesser environmental threat has become imperative. Keeping all these in view, an experiment was planned to manage the pod borers, *M. vitrata*, *H. armigera* and *M obtusa.*

MATERIAL AND METHODS

The experiment was laid out in a Randomized Block Design (RBD) with 11 treatments replicated thrice including untreated control. The size of each plot was $36m^2$ with four rows and 30 plants row^{-1}. The crop received a total of 3 sprays, the first being given at flower bud initiation stage of the crop while 2nd and 3rd sprays were imposed thereafter at 10 days interval. For recording the data, five plants were selected at random in each replication of the treatment leaving border rows. Number of larvae per 5 twigs per plant for *M. vitrata* whereas, number of larvae per 10 twigs per plant for *H. armigera* were recorded one day before treatment as pre-treatment count and at 3, 7 and 10 days after each spray as post-treatment counts.

Pod damage was recorded at the time of harvest. Hundred pods from each plot were collected and were split opened to observe the damaged grains. Depending upon the damage symptoms, the pods were separated and the per cent pod damage by *H. armigera, M. vitrata* and *M. obtusa* was calculated harvesting was done plot wise when the pods attained maturity. The total yield per plot and benefit-Cost ratios were calculated.

RESULTS AND DISCUSSION

The results of the experiment conducted to evaluate the efficacy of certain newer insecticides are presented in Table-1. The perusal of the data showed significant variation in the incidence of larval populations during the post treatment periods at three, seven and ten days after treatment in each of the three sprayings.

Efficacy against *M. vitrata* larval population

The overall mean efficacy of treatments against *M. vitrata* for three sprays indicated that chlorantraniliprole (20 EC) @ 0.3 ml l^{-1} (92.83%), flubendiamide (480 SC) @ 0.2 ml l^{-1} (87.73%) were the most effective and significantly superior to all the other treatments. The results are in conformity with AICRP on Pulses (2010-11) who recorded the highest per cent reduction in larval population of *Maruca* (95.60%) with DDVP 76EC+Rynaxypyr 20 EC in pigeonpea.

The next best treatments metaflumizone (22 SC) @ 2ml l^{-1} (76.71%) and thiodicarb (75 WP) @ 1.5 g l^{-1} (76.52%) were being on par and significantly superior to the rest of the treatments. Next came, dimethoate (30 EC) @ 2ml l^{-1} (65.19%) and lambda cyhalothrin (5 EC) @ 1 ml l^{-1} (64.19%) being on par with each other. Chlorpyriphos+dichlorvos (76 EC) @ 2.5+1 ml l^{-1} (62.03%), novaluron (10 EC @ 1 ml l^{-1}) (61.48%) and profenophos (50 EC) @ 2ml l^{-1} (60.84%) were being on par with each other. Among all the treatments quinalphos (25 EC) @ 2 ml l^{-1} (54.22%) was the least effective over untreated control. However, all the treatments were significantly superior over control.

Efficacy against *H. armigera* larval population

Based on the overall performance of the test insecticides after three sprays against *H. armigera* revealed that the treatments chlorantraniliprole (20 EC) @ 0.3 ml l^{-1} (89.58%) and flubendiamide (480 SC) @ 0.2 ml l^{-1} (86.89%) were the most effective and significantly differed with other treatments. The superiority of chlorantraniliprole against *H. armigera* has been reported by Rajesh chowdary *et al.* (2010) who inferred that the Rynaxypyr 20%SC @ 30 g a.i. ha^{-1} and 20 g a.i. ha^{-1} were superior by recording less larval population of okra fruit borer *H. armigera*. The results about flubendiamide (480 SC) @ 0.2 ml l^{-1} are in conformity with Kuttalam *et al.* (2008) in Tomato and Patil *et al.* (2008) in Blackgram against *H. armigera.*

Metaflumizone (22SC) @ 2ml l^{-1} and thiodicarb 75 WP 1.5 g l^{-1} were the next best treatments with 75.82 and 71.67 per cent population reduction over control. The remaining treatments lambda cyhalothrin (5 EC @ I ml l^{-1}) (62.64%), dimethoate (30 EC @ 2ml l^{-1}) (59.53%), chlorpyriphos+dichlorvos (76 EC) @ 2.5+1 ml l^{-1} (55.44%), profenophos (50 EC) @ 2ml l^{-1} (54.38%) and quinalphos (25 EC) @ 2 ml l^{-1} (54.14%) were recorded more than 54 per cent larval population reduction over control. The low population reduction was recorded in novaluron (10 EC @ 1 ml l^{-1}) (49.51%). However, all the treatments were superior over control in bringing down the larval population.

Effect on Pod damage due to *H. armigera*

The per cent pod damage due to *H.armigera* (Table 2) ranged from 0.33 to 18.31%. Among the treatments chlorantraniliprole (20 EC) @ 0.3 ml l^{-1} and flubendiamide (480 SC) @ 0.2 ml l^{-1} were the most effective and being on par and with 0.33 and 0.64 per cent pod damage. The next best were metaflumizone (22 SC) @ 2ml l^{-1} and thiodicarb (75 WP) @ 1.5 g l^{-1} being on par with 3.63 and 3.89 per cent pod damage were on par and significantly superior over remaining genotypes with less than 8 per cent pod damage. The remaining treatments Profenophos (50 EC) @ 2ml l^{-1} (6.74%), chlorpyriphos + dichlorvos (76EC) @ 2.5+1 ml l^{-1} (7.22%), dimethoate (30 EC) @ 2ml l^{-1} (9.95%), lambda cyhalothrin (5 EC) @ 1 ml l^{-1} (11.31%), novaluron (10 EC) @ 1 ml l^{-1} (11.31%) and quinalphos (25 EC) @ 2 ml l^{-1} (11.94%) recorded less than 12% pod damage. However, all the treatements were significantly superior in reducing pod damage over control (18.31%). The results are in line with Rajavel *et al*. (2009) who reported that rynaxypyr 20%SC (150g *a.i.* ha^{-1}) recorded lowest mean per cent early shoot borer damage (0.20%) in sugarcane. Ashok Kumar and Shivaraju (2009) reported that flubendiamide (480 SC) @ 48 g *a.i.* ha^{-1} and 36 g *a.i.* ha^{-1} respectively recorded 6.04 % and 7.62% pod damage against *H. armigera* (Hubner) in blackgram.

Table 1. Efficacy of certain newer insecticides against *M. vitrata* and *H. armigera*.

S.No	Treatments	Dosage l^{-1} (Conc.)	*M. vitrata* Mean population per 5 plants before spray	*M. vitrata* Percentage reduction in larval population over control 3 DAT	7 DAT	10 DAT	Overall efficacy	*H. armigera* Mean population per 5 plants before spray	*H. armigera* Percentage reduction in larval population over control 3 DAT	7 DAT	10 DAT	Overall efficacy
T_1	Chlorpyriphos (20 EC) +	2.5+1.0 ml	12.44	68.83 (56.17)^{cd}	58.01 (49.72)^{cd}	59.11 (50.32)^{ef}	62.03 (52.00)^{cd}	10.56	73.44 (59.06)^{d}	50.37 (45.23)^{e}	42.53 (40.70)^{ef}	55.44 (44.06)^{de}
T_2	Dichlorvos (76 EC)											
	Profenophos (50 EC)	2.0 ml	12.47	64.95 (53.78)^{cd}	57.66 (49.48)^{cd}	59.89 (50.85)^{def}	60.84 (51.33)^{cd}	9.36	72.75 (58.60)^{d}	47.47 (43.56)^{e}	42.92 (40.94)^{def}	54.38 (43.70)^{de}
T_3	Thiodicarb (75WP)	1.5 g	7.61	83.98 (66.58)^{ab}	72.94 (58.82)^{b}	72.65 (58.61)^{bc}	76.52 (61.20)^{b}	7.81	81.57 (64.90)^{c}	73.16 (58.83)^{b}	60.29 (51.06)^{c}	71.67 (49.81)^{bc}
T_4	Novaluron (10 EC)	1.0 ml	10.25	65.03 (53.84)^{cd}	61.00 (51.46)^{c}	58.43 (49.88)^{ef}	61.48 (51.72)^{cd}	10.14	70.37 (57.14)^{d}	46.00 (42.72)^{e}	32.16 (34.42)^{f}	49.51 (41.96)^{e}
T_5	Quinalphos (25 EC)	2.0 ml	11.61	61.94 (51.99)^{d}	48.34 (44.04)^{d}	52.38 (46.41)^{f}	54.22 (47.46)^{d}	7.71	67.96 (55.60)^{d}	54.35 (47.52)^{de}	40.13 (39.26)^{ef}	54.14 (43.55)^{de}
T_6	Dimethoate (30 EC)	2.0 ml	8.55	66.88 (54.98)^{cd}	58.89 (50.20)^{cd}	69.79 (56.77)^{bcd}	65.19 (53.89)^{c}	6.55	70.36 (57.05)^{d}	60.40 (51.03)^{cd}	47.85 (43.74)^{de}	59.53 (45.37)^{de}
T_7	Lambdacy halothrin (5 EC)	1.0 ml	9.80	67.87 (55.53)^{cd}	58.75 (50.08)^{cd}	65.97 (54.36)$^{c\ de}$	64.19 (53.31)^{c}	5.27	72.72 (58.58)^{d}	60.27 (50.95)^{cd}	54.92 (47.88)^{cd}	62.64 (46.45)^{cd}
T_8	Flubendiamide (480 SC)	0.2 ml	6.98	84.02 (67.17)^{ab}	87.20 (70.87)^{a}	92.08 (73.73)^{a}	87.73 (70.08)^{a}	4.45	91.35 (73.23)^{ab}	85.30 (67.54)^{a}	84.02 (66.73)^{ab}	86.89 (56.32)^{a}
T_9	Chlorantraniliprole (20 SC)	0.3 ml	6.52	88.44 (70.95)^{a}	94.19 (76.43)^{a}	95.86 (78.39)^{a}	92.83 (74.86)^{a}	4.39	92.00 (74.61)^{a}	87.45 (69.32)^{a}	89.29 (71.39)^{a}	89.58 (57.95)^{a}
T_{10}	Metaflumizone (22 SC)	2.0 ml	7.52 15.60	75.77 (60.91)^{bc}	77.24 (61.58)^{b}	77.14 (61.54)^{b}	76.71 (61.33)^{b}	6.04 14.70	86.04 (68.17)^{bc}	65.55 (54.28)^{bc}	75.86 (60.68)^{b}	75.82 (51.45)^{b}
T_{11}	control			0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
F-test				S	S	S	S		S	S	S	S
SEm(±)				2.29	2.16	1.91	1.74		1.85	1.60	2.24	2.30
CD (P=0.05)				6.76	6.38	5.65	5.13		5.45	4.72	6.61	6.79
C V (%)				7.38	7.32	6.28	5.74		5.62	5.75	8.60	7.98

Values in the parentheses are Arc Sine transformed values S: Significant DAT: Days after treatment

Numbers followed by same letter in each letter in each column are not significantly different

Effect on Pod Damage due to *M. vitrata*

The data pertaining to per cent pod damage due to *M. vitrata* (Table 2) ranged from 0.33 to 26.30%. Among all the treatments chlorantraniliprole (20 EC) @ 0.3 ml l^{-1} and flubendiamide (480 SC) @ 0.2 ml l^{-1} were effective by recording 0.33 and 0.42 per cent pod damage, respectively. Metaflumizone (22 SC) @ 2ml l^{-1} was the next best treatment with 2.97 per cent pod damage over control and significantly differed with all other treatments. The remaining treatments, Thiodicarb (75 WP) @ 468 g *a.i.* ha^{-1}, novaluron (10 EC) @ 1 ml l^{-1}, lambda cyhalothrin (5 EC) @ 1 ml l^{-1}, chlorpyriphos + dichlorvos (76 EC) @ 2.5+1 ml l^{-1}, Profenophos (50 EC) @ 2ml l^{-1} and dimethoate (30 EC) @ 2ml l^{-1} recorded 7.08, 7.17, 7.94, 9.63, 15.38 and 19.31 per cent pod damage, respectively. Among all treatments high per cent pod damage (23.23%) was observed in plots treated with quinalphos (25 EC) @ 2 ml l^{-1}. However, all the treatments were significantly superior over control (26.30%). The present findings are in conformity with Haritha (2008) who reported that rynaxypyr 0.009% recorded 45.51 per cent reduction of pod damage due to *M. vitrata* over control in pigeonpea. Patil *et al.*, 2008 recorded

Table 2. Efficacy of certain newer insecticides on pod damage due to pod borer complex .

S.No	Treatments	Dosage l^{-1} (Conc.)	Per cent pod damage due to *H. armigera*	*M. vitrata*	*M. obtusa*
T_1	Chlorpyriphos(20 EC) + Dichlorvos(76 EC)	2.5+1.0 ml	7.22 $(15.59)^c$	9.63 $(18.08)^c$	4.83 $(12.56)^b$
T_2	Profenophos (50EC)	2.0 ml	6.74 $(15.05)^c$	15.38 $(23.09)^d$	5.42 $(13.44)^b$
T_3	Thiodicarb (75WP)	1.5 g	3.89 $(11.37)^b$	7.08 $(15.43)^c$	18.00 $(25.11)^d$
T_4	Novaluron (10EC)	1.0 ml	11.31 $(19.66)^d$	7.17 $(15.50)^c$	17.04 $(24.39)^d$
T_5	Quinalphos (25EC)	2.0 ml	11.94 $(20.22)^d$	23.23 $(28.81)^{ef}$	4.68 $(12.48)^b$
T_6	Dimethoate (30EC)	2.0 ml	9.95 $(18.39)^d$	19.31 $(26.07)^{de}$	2.56 $(9.07)^a$
T_7	Lambda-cyhalothrin (5 EC)	1.0 ml	11.31 $(19.65)^d$	7.94 $(16.36)^c$	11.61 $(19.90)^c$
T_8	Flubendiamide (480 SC)	0.2 ml	0.64 $(3.74)^a$	0.42 $(2.14)^a$	16.30 $(23.81)^d$
T_9	Chlorantraniliprole (20 SC)	0.3 ml	0.33 $(1.91)^a$	0.33 $(1.91)^a$	9.24 $(17.67)^c$
T_{10}	Metaflumizone (22 SC)	2.0 ml	3.63 $(10.96)^b$	2.97 $(9.91)^b$	25.70 $(30.47)^e$
T_{11}	Control		18.31 $(25.35)^e$	26.30 $(30.85)^f$	29.23 $(32.74)^e$
F-test			S	S	S
SEm±			0.93	1.04	0.77
CD(P=0.05)			2.75	3.07	2.28
C.V (%)			10.97	10.54	6.64

Values in the parentheses are Arc Sine transformed values S: Significant DAT: Days after treatment
Numbers followed by same letter in each column are not significantly different

Table 3. Effect of certain newer insecticides on yield in Pigeonpea and their Benefit- Cost Ratios.

S.No	Treatments	Dosage l^{-1} (Conc.)	Yield (kg/ha)	Per cent increase over control	Benefit – Cost ratio
T_1	Chlorpyriphos(20 EC) + Dichlorvos (76 EC)	2.5+1.0 ml	420.00	33.57	1.21
T_2	Profenophos (50EC)	2.0 ml	402.00	30.60	1.14
T_3	Thiodicarb (75WP)	1.5 g	445.33	37.35	1.15
T_4	Novaluron (10EC)	1.0 ml	410.77	32.08	1.02
T_5	Quinalphos (25EC)	2.0 ml	395.00	29.37	1.11
T_6	Dimethoate (30EC)	2.0 ml	415.00	32.77	1.15
T_7	Lambda-cyhalothrin (5 EC)	1.0 ml	430.33	35.17	1.20
T_8	Flubendiamide (480 SC)	0.2 ml	531.77	47.53	1.36
T_9	Chlorantraniliprole (20 SC)	0.3 ml	569.00	50.97	1.40
T_{10}	Metaflumizone (22 SC)	2.0 ml	475.33	41.30	1.26
T_{11}	Control		279.00	0.00	0.82
F-test			Sig.		
SEm±			15.86		
CD(P=0.05)			46.78		
C.V (%)			6.33		

lowest pod damage 9.98% in flubendiamide 480SC @48 g *a.i* ha^{-1} against pod borers in blackgram.

Effect on Pod Damage due to *M. obtusa*

The observations made on the pod damage due to *M. obtusa* (Table 2) ranged from 2.56 to 29.23%. The data revealed that the per cent damage was significantly reduced in plots treated with dimethoate (30 EC) @ 2ml l^{-1} (2.56%) followed by quinalphos (25 EC)@ 2 ml l^{-1}, chlorpyriphos +dichlorvos (76 EC) @ 2.5+1 ml l^{-1} and profenophos (50 EC) @ 2ml l^{-1} with 4.68, 4.83 and 5.42 per cent pod damage and 83.98, 83.49 and 81.47 per cent reduction over control, respectively. The treatments chlorantraniliprole (20 EC) @ 0.3 ml l^{-1} (9.24%) and lambda cyhalothrin (5 EC) @ 1 ml l^{-1} (11.61%), flubendiamide (480 SC) @ 0.2 ml l^{-1} (16.30%), novaluron (10 EC) @ 1 ml l^{-1} (17.04%) and thiodicarb (75 WP) @ 468 g a.i. ha^{-1} (18.00%) recorded less than 20% pod damage. However, all the treatments were significantly superior over control (29.23%). The present findings were also proved by Dar *et al*. (2009b) who reported that two sprays of dimethoate, profenophos and quinalphos recorded minimum grain damage (13.5 to 21.6%) due to pod fly in redgram.

Effect on Yield

The yield data (Table-3), chlorantraniliprole (20 EC) @ 0.3 ml l^{-1} and flubendiamide (480 SC) @ 0.2 ml l^{-1} were superior and recorded higher yields of 569 and 532 kg ha^{-1} respectively. The next best treatments were metaflumizone (22 SC) @ 2ml l^{-1} and thiodicarb (75 WP) @ 468 g *a.i*. ha^{-1} with 475.33 kg ha^{-1} and 445.33 kg ha^{-1}, respectively. However, all the treatments were significantly superior to untreated control (291 kg ha^{-1}). Patil *et al*. (2008) reported higher yield in blackgram with flubendiamide 480 SC @ 8g *a.i* ha^{-1}. The high Benefit Cost Ratio was observed in Chlorantraniliprole (1.40:1) and flubendiamide (1.36:1).

LITERATURE CITED

AICRP 2010-11 Annual Report. All India Co-ordinated Research Project on Pulses.Indian Institute of Pulses Research, Kanpur-208024.

Ashok Kumar C T and Shivaraju C 2009 Evaluation of newer insecticide molecules against pod borers of blackgram. *Karnataka Journal of Agricultural Sciences,* 22 (3): 521-523.

Dar M H, Rizvi P Q and Saxena Hem 2009b Evaluation of potent insecticides against podfly (*Melanagromyza obtusa*) and its parasitoids in late pigeonpea (*Cajanus cajan* L. Millsp.). *Current Advances in Agricultural Sciences*, 1 (2): 114-116.

Durairaj C 1995 Ecology and management of tur podfly, *Melanagromyza obtusa* in pigeonpea. Unpublished *Ph.D.Thesis*, Tamil Nadu Agricultural University, Coimbatore, India.

FAO 2005 Agricultural Production Statistics, United Nations.

Haritha B 2008 Biology and management of *Maruca vitrata* (Geyer) in pigeonpea. *M.Sc(Ag) Thesis*. Acharya N G Ranga Agricultural University, Hyderabad, India.

ICRISAT2007 The medium term plan. International Crops Research Institute for the Semi-Arid Tropics. Patancheru 502 324, Andhra Pradesh. Vol-3.

Patil S K, Deshmukh and Patil J V 2008 Efficacy of Flubendiamide 480 SC against pod borers in blackgram. *Pestology*, 32 (9): 20-22.

Rajavel D S, Pandi R and Usha Rani B 2009 Efficacy of Rynaxypyr 20% SC in the control of sugarcane early shoot borer, *Chilo infuscatellus* Snell. *Pestology*, 33 (5): 41-44.

Rajesh Chowdary L, Bheemanna M and Ranjith Kumar L 2010. Bioefficacy of rynaxypyr (Coragen) 20 SC against fruit borer *Helicoverpa armigera* (Hubner) in okra. *International Journal of Plant Protection,* 3 (2): 379-381.

Saxena K B, Chandrasena G D S N, Hettiarachchi K, Iqbal Y B, Fonseka H H D and Jayasekara S J B A 2002 Evaluation of pigeon pea accessions and selected lines for reaction to *Maruca. Crop Science,* 42: 615-618.

(Received on 11.06.2012 and revised on 18.01.2013)