Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(1): 1186-1188

Received: 09-11-2018
Accepted: 12-12-2018

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Efficacy of botanical insecticides against pod borer (*Maruca vitrata*) on cowpea (*Vigna unguiculata*)

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Abstract
The field experiment was conducted during kharif 2016-17 to evaluation of botanical insecticides against pod borer on cowpea. Two rounds of insecticides were sprayed at fifteen days interval. The most effective treatment evaluated against pod borer was chlorpyriphos 20 EC@ 300g a.i. ha^{-1} during first spray (1.97, 1.74 and 1.53 larvae /m^2 at 3, 5, and 7 days after spray, respectively) and second spray (1.51, 1.54 and 1.93 larvae /m^2 at 3, 5 and 7days after spray, respectively) followed by neem oil @ 2 % first spray (4.30, 4.08 and 3.52 larvae /m^2) second spray (3.00, 2.85 and 3.28 larvae /m^2) and NSKE @ 5 % during first spray (4.62, 4.18 and 3.81 larvae /m^2) second spray (3.12, 3.09 and 3.37 larvae /m^2) respectively. The maximum larval population was found in untreated plot. The highest green pod yield of cowpea was recorded in Chlorpyriphos 20 EC@300g a.i. ha^{-1} (53.12 qha^{-1} followed by neem oil @ 2% (43.53 qha^{-1}) and NSKE @ 5% (42.11 qha^{-1}) while lowest yield recorded in untreated control plot (32.16 qha^{-1}).

Keywords: Evaluation, cowpea, pod borer, botanical insecticides

Introduction
Cowpea (*Vigna unguiculata*) is important legume crops belong to family Leguminaceae. Cowpea is known as vegetable meat due to high amount of protein in the grain with better biological value on dry weight basis. The grain contains 26.61 % protein, 3.99 % lipid, 56.24 % carbohydrates, 8.60 % moisture, 3.84 % ash, 1.38% crude fiber, 1.51 % gross energy, and 54.85% nitrogen free extract (Owolabi *et.al.* 2012) [8]. The pod borer complex posing serious threat to cowpea cultivation includes *Maruca vitrata* (Fabricius), *Lampides boeticus* (L.), *Helicoverpa armigera* (Hubner), *Etiella zinckenella* Treitsche, *Adisura atkinsoni* Moore and *Exelastis atomosa* (Walsingham). Application of highly toxic chemical insecticides at short intervals against insect pests has resulted in many deleterious effects such as residual toxicity, insecticide resistance, pest resurgence, destruction of natural enemies and environmental pollution. In this context, the relevance of the use of botanicals, newer chemicals for managing pod borer complex assumes greater significance. Azadirachtin containing formulations are effective in reducing the larval population of pod borers and contribute to a higher yield (Singh and Yadav, 2006) [9]. The major constraint in the cultivation of cowpea is insect pest attack which has been observed to have caused up to 70 % grain yield loss (Adipala *et al.*, 2005) [1]. Among the insecticides, the botanical insecticides are naturally occurring, often slow-acting crop protectant and minimal residual effects. Therefore the plant pesticides have been recommended ever more as a suitable alternative of plant protection with minimum negative risks (Isman, 2006) [6]. So that the present study were undertaken to the evaluation and efficacy of botanical insecticides against spotted pod borer on Cowpea (*Vigna unguiculata*).

Materials and methods
The field experiment was conducted at the farm of the college of agriculture and research station, Boirdadar, Raigarh during *Kharif* 2016-17. The experiment was laid out in randomized block design (RBD) with eight treatments (Table -1) and three replications. The plot size was 5x4 meter (m) and the seeds of cowpea were sown at 45x30 centimeter (cm) spacing during the last week of July. Cowpea variety Gomti is used for experiment. All agronomic practices except plant protection were followed as and when required. The spraying of botanical and conventional insecticides was applied at the initial incidence of pod borer and two sprays were

given. All the spraying was done by using knapsack sprayer at 15 days intervals. The one m^2 area randomly selected plants were marked to count the number of pod borer larvae before spray, 3, 5 and 7 days after each spray. The green pod yield was recorded from per plot and converted into quintal per hectare. The calculated data of pod borer larvae were transformed into square root values $\sqrt{x+0.5}$ as per the standard requisites (Gomez and Gomez, 1984) [3].

Per cent reduction in larval population over control was calculated by using following modified given formula given by Henderson and Tilton, 1955 [4].

Per cent reduction over control =

Table 1: Treatment Details

Treatment	Treatment Details
T_1	Neem Oil @ 2%
T_2	NSKE @ 5%
T_3	Karanj Oil @ 2%
T_4	Karanj Seed Powder @ 30kg/ha
T_5	Chilli + Garlic Solution @ 9kg/ha
T_6	Chilli Solution @ 10kg/ha
T_7	Chlorpyriphos 20EC @ 2ml/lit.
T_8	Untreated Control –Plain water spray

Result and Discussion

The result presented in Table-2 revealed that the larval population of pod borer in cowpea was significantly reduced in treated plants as compared to untreated plants after each of the first and second application. There was no significant difference was observed in pre-treatment count of larvae of pod borer the data ranged from before first spray and second spray.

After first spray, among the different botanical and conventional insecticides the minimum number of larval population of pod borer in cowpea was found in chloropyriphos 20 EC @ 2 ml litre^{-1} water *i.e.* 1.97, 1.74 and 1.53 larvae /m^2 at 3,5 and 7 days after spray (DAS), respectively followed by botanical insecticide neem oil @ 2% *i.e.* 4.30, 4.08 and 3.52 larvae /m^2 and NSKE @ 5% *i.e.* 4.62, 4.18 and 3.81 larvae /m^2 at 3, 5 and 7 DAS, respectively. The maximum larval population of 8.11, 9.39 and 9.53 larvae /m^2 at 3, 5 and 7 DAS was recorded in control untreated plots. The overall per cent reduction over control treatment was highest in chloropyriphos 20 EC @ 2 ml litre^{-1} water *i.e.* 80.84% (1.75 larvae /m^2) followed by neem Oil @ 2 % *i.e.* 54.0 % (3.97 larvae /m^2) and NSKE @ 5% *i.e.* 53.54 % (4.20 larvae /m^2).

Table 2: Efficacy of botanical insecticides against larval population of pod borer in Cowpea during Kharif 2016

Treatment	Pre-treatment (larvae /m^2)	Larval population at different DAS during first spray (larvae /m^2)					Pre-treatment (larvae /m^2)	Larval population at different DAS during first spray (larvae /m^2)				
		3DA5	5DAS	7DAS	Mean	PROC		3DA5	5DAS	7DAS	Mean	PROC
T_1	16.61 (4.12)	4.30 (2.19)	4.08 (2.14)	3.52 (2.00)	3.97 (2.11)	54.00	13.14(3.69)	3.00 (1.87)	2.85 (1.83)	3.28 (1.94)	3.04 (1.88)	59.38
T_2	17.40 (3.23)	4.62 (2.26)	4.18 (2.16)	3.81 (2.08)	4.20 (2.17)	53.55	13.21 (3.70)	3.12 (1.90)	3.09 (1.90)	3.37 (1.97)	3.19 (1.92)	57.60
T_3	20.76 (4.59)	5.67 (2.49)	5.16 (2.38)	5.14 (2.37)	5.32 (2.41)	50.68	12.43 (3.59)	3.53 (2.01)	3.47 (1.99)	3.97 (2.11)	3.66 (2.04)	48.30
T_4	17.87 (4.04)	5.25 (2.40)	5.02 (2.35)	4.90 (2.32)	5.06 (2.36)	45.51	13.88 (3.79)	3.47 (1.99)	3.36 (1.96)	3.83 (2.08)	3.55 (2.01)	55.09
T_5	18.79 (4.38)	4.94 (2.33)	4.70 (2.28)	4.24 (2.18)	4.63 (2.26)	52.58	13.23 (3.71)	3.27 (1.94)	3.22 (1.93)	3.45 (1.99)	3.31 (1.95)	56.07
T_6	20.70 (4.60)	5.97 (2.54)	5.56 (2.46)	5.73 (2.50)	5.75 (2.50)	46.54	13.95 (3.80)	3.64 (2.04)	3.63 (2.03)	4.17 (2.16)	3.81 (2.08)	52.05
T_7	17.58 (4.24)	1.97 (1.57)	1.74 (1.50)	1.53 (1.43)	1.75 (1.50)	80.84	14.26 (3.84)	1.51 (1.42)	1.54 (1.43)	1.93 (1.56)	1.66 (1.47)	79.56
T_8	17.34 (4.22)	8.11 (2.94)	9.39 (3.13)	9.53 (3.16)	9.01 (3.08)	-	13.66 (3.76)	6.15 (2.58)	8.01 (2.91)	9.18 (3.11)	7.78 (2.86)	-
Sem	-	0.04	0.08	0.05	0.06		-	0.04	0.05	0.06	0.05	
CD at 5%	NS	0.11	0.25	0.14	0.17		NS	0.13	0.16	0.17	0.15	

Note: Figure in parenthesis is square root transformed value,
DAT: Days after Spraying,
PROC: Percent Reduction over Control

In second spray, the minimum larval population was found in chloropyriphos 20 EC@ 2 ml litre^{-1} water *i.e.* 1.51, 1.54 and 1.93 larvae /m^2 at 3, 5 and 7 DAS followed by Neem Oil @ 2 % (3.00, 2.85 and 3.28 at 3, 5 and 7 DAS, respectively) and NSKE @ 5% (3.12, 3.09 and 3.37 at 3, 5 and 7 DAS, respectively). The overall per cent reduction over control treatment was highest in chloropyriphos 20 EC @ 2 ml litre^{-1} water *i.e.* 79.56% (1.66 larvae /m^2) followed by neem Oil @ 2 % *i.e.* 59.38% (3.04 larvae /m^2) and NSKE @ 5% *i.e.* 57.6.% (3.19 larvae /m^2). The chloropyriphos 20 EC @ 2 ml litre^{-1} water was effective to minimize larval population of in cowpea. In the present study the botanical insecticide performs well to reduce the larval population of pod borer in cowpea The result has been reported that (Irulandi and Balasubramaniam, 2000) [5] the effectiveness of NSKE against *M. testulalis* infesting green gram and *H. armigera* infesting green pod of Indian bean (Dalwadi *et al.*, 2008) [2] all these reports are similar with the present results. The neem based extract reduce pod borer and protect the cowpea plants. It might have been absorbed by the flowers/pods through osmotic pressure causing the insect to stop feeding (Oparaeke *et al.*, 2005) [7].

Table 3: Botanicals insecticidal impact on total green pod yield of cowpea

Treatment	Green pod Yield (q/ha)	Increased yield over control (q/ha)
T_1	43.53	11.37
T_2	42.11	9.95
T_3	40.08	7.92
T_4	41.44	9.28
T_5	41.86	9.70
T_6	38.59	6.43
T_7	53.12	20.96
T_8	32.16	-
Sem	1.37	
CD at 5%	4.15	

The data presented in Table 3 indicated that with the application of treatment the green pod yield of cowpea was significantly increased in all the treatments as compare to untreated control. The highest green pod yield was recorded in chloropyriphos treatment (53.12 q ha^{-1}) followed by neem oil @ 2 % (43.53 q ha^{-1}) and NSKE @ 5% (42.11 q ha^{-1}). The lowest yield was recorded in untreated plot (32.16 q ha^{-1}) followed by chilli solution 10 kg ha^{-1}(38.59 q ha^{-1}). These findings are closely with the result of in Indian bean (Subhasree and Mathew, 2014) [10].

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