International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 12, Issue 2, 2020, pp.-9454-9457.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

BIO-EFFICACY OF SOME NEW INSECTICIDES ON SPOTTED POD BORER, *Maruca vitrata* (GEYER) IN CLUSTERBEAN

MEENA RAM KISHOR*[1], MEENA RAVINDRA KUMAR[2], SINGH U.[1], MEENA M.L.[1], KUMAR S.[3] AND SHARMA Y.K.[1]

[1]College of Agriculture, Lalsot, Dausa, 303503, Sri Karan Narendra Agriculture University, Jobner, 303329, Rajasthan, India
[2]Department of Plant Breeding and Genetics, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, 385506, Gujarat, India
[3]Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana, 141027, Punjab, India
*Corresponding Author: Email - ramkishorento@gmail.com

Received: January 04, 2020; Revised: January 24, 2020; Accepted: January 27, 2020; Published: January 30, 2020

Abstract: The present experiments were conducted during three consecutive *kharif* seasons (2015-17) to study the effect of commercially available insecticides formulations, Emmamection Benzoate 0.5% SG (0.5 gm/ litre of water),Quinalphos 25% EC (2.0 ml/ lit.), Novaluron 10 % EC (1.0 ml/ lit.), Neem oil 2% (20 ml/lit.), Karanj oil 2% (20 ml/lit.) against the Spotted pod borer, *Maruca vitrata* in Clusterbean. The descending order of most effective insecticide was: Emmamection Benzoate>Quinalphos > Novaluron. During 2015 year the maximum population reduction over control was found after 7 days of application of second spray at 15 days of interval viz., 77.21 and 66.83 percent due to Emmamection Benzoate, Quinalphos respectively. A similar trend was found in 2016 and 2017. Thus, Emmamection Benzoate was found most effective against the Spotted pod borer, *Maruca vitrata* Geyer (Lepidoptera: Pyralidae) in Clusterbean.

Keywords: *Clusterbean and Spotted pod borer, Maruca vitrata*

Citation: Meena Ram Kishor, *et al*., (2020) Bio-Efficacy of Some New Insecticides on Spotted Pod Borer, *Maruca vitrata* (Geyer) in Clusterbean. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 12, Issue 2, pp.- 9454-9457.

Academic Editor / Reviewer: Dr A Srividhya, Dr N Umashankar Kumar, Rajpal Diwakar, Lokeshwari N., Julian A Valencia A

Introduction

Cluster bean, *Cyamopsis tetragonoloba* is native to India and has been cultivated in the country for ages. Cluster bean is known for having tolerance against high temperature and drought [1]. Clusterbean is widely used as green manuring, fodder and vegetable. Commercially. The tender green pods of Clusterbean are cheap sources of nutrition. High protein containing Clusterbean pods and fodder is good for animal health [2]. Cluster bean gum is naturally present in the seed endosperm as hydrocolloid [26]. Export quality Clusterbean variety should contain 4000-5000 cps viscosity and more than 32% gum content. India's foreign exchequer (Rs 21000 Million) is greatly contributed by Clusterbean export in 2012-13 [3]. Clusterbean crop mostly grown under resource constrained conditions in arid and semi-arid regions [4].

The major cluster bean cultivating countries are India, Pakistan, USA, Italy, Morocco, Germany, and Spain [5]. India accounts nearly 80% production of Clusterbean in the global scenario [6]. Cluster bean can be used for many purposes like vegetable, cattle feed/fodder or green manuring. In India, cluster bean is mostly grown in Rajasthan, Haryana, Punjab, Uttar Pradesh and Madhya Pradesh. Rajasthan occupies first position in India both in area and production. It accounts for almost 82.1 percent area and 70% production in India. Haryana and Gujarat have second and third position respectively. Rajasthan has an area of 46.30 lakh hectare, production of 27.47 M tones with a productivity of 593 kg/ha [7]. Cluster bean is grown especially in the arid regions of India (Rajasthan, Haryana, Gujarat and Punjab) for gum purpose, whereas it is grown for vegetable purpose in other parts of India.

In Rajasthan, Clusterbean is mainly grown in Barmer, Churu, Sriganganagar, Nagaur, Jalore, Sikar, Jaisalmer, Bikaner, Jaipur, Jhunjhunu and Alwar districts [8]. The annual yield loss is estimated to be 30 percent in black gram and green gram. On an average 2.5 to 3.0 million tonnes of pulses are lost annually due to pests [9].

The management strategies involve the use of resistant varieties, use of disease-free seeds, manipulation of cultural practices, management of vectors, and biological and chemical control methods [10,11]. Due to its more vegetative growth, number of insect's attack from seedling to harvesting stage which is detrimental factor for production and causing severe yield losses [12]. Timing of insecticidal application as foliar sprays is the most important basic requirement for effective control of insect pests in greengram [13]. Hence, in the present study, insecticides were evaluated for scheduling the foliar sprays against major insect pests in Clusterbean.

Materials and Methods

The present study field trials on evaluation of insecticides schedule were conducted at the Experimental Farm of Agricultural Research Station, Navgaon, Alwar (Rajasthan) during *Kharif* 2015, 2016 and 2017. The HG 2-20 was selected as test variety and the seed was sown in plots each measuring 15 sq.m at 30 x 10 cm spacing. The crop was sown during first fortnight of July and harvested during September at maturity during all the seasons. A total of 5 insecticide schedule treatments were evaluated including untreated control and each treatment was replicated thrice. Five insecticides *i.e*. Emmamection Benzoate 0.5% SG (0.5 gm/ litre of water), Quinalphos % 25 EC (2.0 ml/ lit.), Novaluron 10 % EC (1.0 ml/ lit.), Neem oil 2% (20 ml/lit.), Karanj oil 2% (20 ml/lit.) with different modes of action were selected against spotted pod borer for the present study. The conventional insecticides such as Quinalphos % 25 EC was selected as standard insecticide checks against Spotted pod borer along with one untreated check. One spray was given at 30 DAS followed by second spray at 45 DAS against spotted pod borer using water volume of 500 litre per hectare.

The population counts of Spotted pod borer were recorded on one day before spraying was considered as pre-treatments counts for first spraying and the post-treatment counts were recorded from ten randomly selected plants per plot after

Table-1 *Efficacy of different insecticides against Spotted pod borer, Maruca testulalis in Clusterbean during kharif 2015*

S	Treatments g.a.i./ha	Formulation Dose (g/ml/ha)	PTP/ Plants	Mean reduction (%) in population days after									
				First spray					Second spray				
				1 DAS	3 DAS	5 DAS	7 DAS	14 DAS	1 DAS	3 DAS	5 DAS	7 DAS	14 DAS
1	Emmamection Benzoate 0.5% SG	0.5 gm/ litre of water	5.07	55.65 (48.20)	59.50 (50.46)	63.64 (52.91)	71.53 (57.74)	63.04 (52.68)	65.15 (53.80)	66.48 (54.62)	68.80 (56.03)	77.21 (61.48)	63.97 (53.10)
2	Novaluron 10 % EC	1.0 ml/ litre of water	4.47	36.17 (36.95)	41.01 (43.11)	46.13 (42.74)	55.47 (48.10)	47.47 (43.51)	48.93 (44.40)	50.52 (45.27)	52.81 (46.39)	61.56 (51.68)	47.94 (43.78)
3	Quinalphos % 25 EC	2.0 ml/ litre	4.67	42.99 (40.94)	47.48 (43.53)	52.26 (44.93)	61.09 (51.38)	52.67 (46.36)	54.61 (47.60)	56.68 (48.81)	58.99 (50.15)	66.83 (54.82)	53.30 (46.85)
4	Neem oil 2%	20.0 ml/ litre of water	4.07	20.52 (26.88)	26.14 (30.70)	32.83 (34.91)	42.66 (40.76)	34.70 (36.03)	35.88 (36.77)	37.69 (37.85)	42.01 (40.38)	50.19 (44.94)	34.82 (36.29)
5	Karanj oil 2 %	20.0 ml/ litre of water	3.87	10.70 (19.02)	16.80 (24.13)	25.50) (30.24)	35.94 (36.80)	26.29 (30.77)	28.34 (31.94)	31.71 (34.22)	34.70 (36.07)	43.95 (41.49)	26.13 (30.70)
6	Untreated control		3.80	-	-	-	-	-	-	-	-	-	-
	SEm±			0.346	1.311	0.663	0.546	0.514	1.411	0.380	0.515	0.564	0.537
	CD 5%			1.063	4.022	2.033	1.674	1.577	4.329	1.167	1.579	1.731	1.646

Table-2 *Efficacy of different insecticides against Spotted pod borer, Maruca testulalis in Clusterbean during kharif 2016*

S	Treatments g.a.i./ha	Formulation Dose (g/ml/ha)	PTP/ Plants	Mean reduction (%) in population days after									
				First spray					Second spray				
				1DAS	3 DAS	5 DAS	7 DAS	14 DAS	1DAS	3 DAS	5 DAS	7 DAS	14 DAS
1	Emmamection Benzoate 0.5% SG	0.5 gm/ litre of water	5.97	44.78 (41.97)	46.19 (42.80)	56.88 (48.95)	66.33 (54.50)	56.69 (48.26)	58.27 (49.72)	59.31 (50.34)	63.11 (52.55)	70.84 (57.29)	61.31 (51.53)
2	Novaluron 10 % EC	1.0 ml/ litre of water	5.48	28.89 (32.44	30.36 (33.37)	44.18 (41.63)	53.57 (47.03)	44.75 (41.96)	45.66 (42.48)	46.83 (43.17)	47.90 (43.78)	58.58 (49.92)	50.25 (45.12)
3	Quinalphos % 25 EC	2.00 ml/ litre	5.57	33.25) (35.19	35.24 (36.38)	47.81 (43.70)	57.54 (49.33)	47.71 (43.68)	49.12) (44.48	50.75 (45.42)	51.88 (46.07)	61.96 (51.91)	53.02 (46.70)
4	Neem oil 2%	20.0 ml/ litre of water	5.02	13.88) (21.75	17.25 (24.38)	33.44 (35.28)	43.74 (41.38)	34.21 (35.75)	34.83 (36.13)	36.11 (36.89)	38.26 (38.17)	49.24 (44.56)	40.50 (39.49)
5	Karanj oil 2 %	20.0 ml/ litre of water	4.88	8.40 (16.70)	9.88 (18.10)	28.44 (32.18)	39.13 (38.70)	28.26 (28.72)	29.45 (32.80)	31.98 (34.41)	32.96 (35.01)	44.86 (42.01)	35.00 (36.21)
6	Untreated control		6.15	-	-	-	-	-	-	-	-	-	-
	SEm±			0.527	0.637	0.369	0.572	1.426	1.125	0.401	0.386	0.469	0.522
	CD 5%			1.618	1.956	1.133	1.755	4.377	3.452	1.231	1.186	1.438	1.603

Table-3 *Efficacy of different insecticides against Spotted pod borer, Maruca testulalis in Clusterbean during kharif 2017*

S	Treatments g.a.i./ha	Formulation Dose (g/ml/ha)	PTP/ Plants	Mean reduction (%) in population days after									
				First spray					Second spray				
				1 DAS	3 DAS	5 DAS	7 DAS	14 DAS	1DAS	3 DAS	5 DAS	7 DAS	14 DAS
1	Emmamection Benzoate 0.5% SG	0.5 gm/ litre of water	3.57	48.00 (43.85)	46.42 (42.95)	55.20 (47.99)	65.48 (54.02)	55.55 (48.19)	56.60 (48.80)	57.60 (49.37)	61.18 (61.18)	69.77 (56.65)	59.98 (50.76)
2	Novaluron 10 % EC	1.0 ml/ litre of water	4.20	30.66 (33.61)	31.67 (34.24)	43.14 (41.05)	53.42 (46.96)	45.10 (42.19)	44.61 (41.90)	45.72 (42.54)	46.70 (56.35)	58.15 (49.69)	49.45 (44.68)
3	Quinalphos % 25 EC	2.00 ml/ litre	4.00	34.69 (36.08)	36.22 (36.99)	46.57 (43.03)	57.16 (49.12)	47.89 (43.79)	47.88 (43.78)	49.43 (44.68)	50.46 (52.36)	61.34 (51.56)	52.08 (46.19)
4	Neem oil 2%	20.0 ml/ litre of water	4.67	16.91 (24.24)	19.62 (26.21)	33.05 (35.07)	44.23 (41.68)	35.29 (36.43)	34.40 (35.90)	35.62 (36.62)	37.61 (46.81)	49.40 (44.65)	40.28 (39.38)
5	Karanj oil 2 %	20.0 ml/ litre of water	4.80	11.93 (20.19)	12.87 (20.93)	28.38 (32.17)	39.95 (39.20)	29.78 (33.06)	29.38 (32.79)	31.75 (34.29)	32.65 (39.02)	45.31 (42.31)	35.12 (36.33)
6	Untreated control		6.60	-	-	-	-	-	-	-	-	-	-
	SEm±			0.660	0.505	0.338	0.532	0.640	1.059	0.377	0.354	0.436	0.491
	CD 5%			2.026	1.549	1.036	1.631	1.963	3.248	1.155	1.086	1.339	1.506

PTP: Pre-treatment population, Transformed values in parenthesis, DAS- Days After Spraying

one, three, seven and fourteen days of each spray. Fourteenth day population counts formed the pre-treatment counts for the second spray. The larva of Spotted pod borer was counted on whole plant basis [14]. From these data the mean population per ten plants was estimated and after transformation, it was subjected to statistical analysis. Percent reduction in Population were analysed using a formula given by Henderson and Tilton [15] as under:

$$\text{Percent reduction in Population} = 100 \times (1 - T_a \times C_b) / T_b \times C_a$$

Where

T_a = Number of insects after treatment

T_b = Number of insects before treatment

C_a = Number of insects in untreated check after treatment

C_b = Number of insects in untreated check before treatment

The data thus obtained were analyzed statistically by ANOVA after converting it to suitable transformed values. The primary mode of action of Novaluron 10 EC is by disrupting cuticle formation and deposition occurring when insect change from one developmental stage to another and resulting at moulting.

Results and Discussion

In field trial of Clusterbean Emmamection Benzoate 0.5% SG, reduced the larval population of *Maruca vitrata* by 55.65, 44.78 and 48.00 percent after one day of first spraying during 2015, 2016 and 2017 respectively. The efficacy of Emmamection Benzoate 0.5% SG after seven days of first spraying went up to 71.53, 66.33 and 65.48 percent during 2015, 2016 and 2017 respectively. Emmamection Benzoate 0.5% SG found most effective at 7 days of II spraying and reduced the population of spotted pod borer by 77.21, 70.84 and 69.77 percent during 2015, 2016 and 2017 respectively. Emmamection Benzoate 0.5% SG was found most effective followed by Quinalphos 25% EC and novaluron 10 EC against *Maruca vitrata* in percent reduction of population over control at 1, 3, 7, 14 days after I and II spraying during all the three years [Table-1, 2 and 3]. Effectiveness of Quinalphos 25% EC against *Maruca vitrata* in percent reduction over control after one day of first spraying was 42.99, 33.25 and 34.69 percent during 2015, 2016 and 2017 respectively.

The efficacy of Quinalphos 25% EC after seven days of first spraying went up to 61.09, 57.54 and 57.16 percent during 2015, 2016 and 2017 respectively and after 7 days of II spraying population reduced by 66.83, 61.96 and 61.34 percent during 2015, 2016 and 2017 respectively. Karanj oil 2% was least effective treatment against *Maruca vitrata* and reduced the caterpillar population at 1 day after I spraying by 10.70, 8.40 and 11.93 percent during 2015, 2016 and 2017 respectively [Table-1, 2 and 3].

Emmamection Benzoate 0.5% SG controls *Maruca vitrata* and gave highest Mean reduction (%) in larval population by 77.21, 70.84 and 69.77 percent during 2015, 2016 and 2017 respectively at 7 days after II spray of 14 days interval in Clusterbean [Table-1, 2 and 3]. Present findings are conformity with the findings of [16],[28] and [30] reported that Emamectin benzoate 8g a.i. /ha (0.62 larvae/plant) was the most effective treatment in reducing *M. vitrata* population and in T8- *V. lecanii* (1×108 Spores/g) 5g/L (2.18 larvae/plant) it was the least effective one.

Treatments against spotted pod borer and in reducing the pod damage. The next best treatments were indoxacarb 14.5 SC @ 1.0 ml/lt, spinosad 45 SC @ 0.3 ml/lt and novaluron 10 EC @ 1.0 ml/lt with more than 60 percent reduction in larval population of spotted pod borer. The efficacy of flubendiamide 39.35 % SC against different lepidopteron pests in different crops was reported by many of the earlier research workers [16-18]. The control measures on increasing pulse production by spraying the crop with quinalphos 0.05 percent at the time of pod formation was effective against pod borer complex in studies with lepidopteran pests [19].

Novaluron was highly active against *Spodoptera littoralis* (Boisduval) and *Helicoverpa armigera* (Hübner) larvae by ingestion, with persistent biological activity; 8 days after cotton leaves were treated in the field approximately 100% of exposed larvae died, while 30-60% of larvae died when exposed to foliage treated 15 days previously [20-22]. *Helicoverpa armigera* larvae were susceptible to novaluron and lufenuron was more effective in laboratory experiments [23]. *Spodoptera exigua* (Hübner) larvae are highly susceptible to novaluron [24-26]. The results obtained from the present study revealed that the foliar spraying of Emmamection Benzoate 0.5% SG (0.5 gm / lit.) at30 DAS and II spray at 45 days of crop stage offers complete protection against incidence of spotted pod borer in Clusterbean [27-30].

Summary and Conclusion

The results of the present investigation entitled were summarised to study the effect of commercially available insecticides formulations, Emmamection Benzoate 0.5% SG (0.5 gm/ litre of water),Quinalphos % 25 EC (2.0 ml/ lit.), Novaluron 10 % EC (1.0 ml/ lit.), Neem oil 2% (20 ml/lit.), Karanj oil 2% (20 ml/lit.) against Spotted pod borer, *Maruca vitrata* in Clusterbean. Emmamection Benzoate 0.5% SG (0.5 gm / lit.) and Quinalphos % 25 EC (2.0 ml / lit.) were better in reducing the incidence of the Spotted pod borer in clusterbean.

Among all the treatments, Emmamection Benzoate 0.5% SG (0.5 gm / lit.) was found most effective against Spotted pod borer. The remaining treatments were found to be moderately effective against as compared to untreated control in reducing the incidence of borer pests in Clusterbean. From the present study it can be concluded that foliar sprays should be given to protect the crop from spotted pod borer incidence after 30 days. Foliar spray of Emmamection Benzoate 0.5% SG (0.5 gm / lit.) at30 DAS and II spray at 45 days of crop stage offers complete protection against incidence of larvae of spotted pod borer.

Application of research: The research findings may be useful for the farmers, Clusterbean breeders as well as the researchers for further use.

Research Category: Plant Breeding and Genetics

Abbreviations: DAS: Days after spray, CPS: Counts per second

Acknowledgement: Authors are thankful to the College of Agriculture, Lalsot, Dausa, 303503, Sri Karan Narendra Agriculture University, Jobner, 303329, Rajasthan, India.

****Principal Investigator or Chairperson of research: Dr Ram Kishor Meena**
University: Sri Karan Narendra Agriculture University, Jobner, 303329, India
Research project name or number: Research station trials

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Experimental Farm of Agricultural Research Station, Navgaon, Alwar

Cultivar / Variety / Breed name: Clusterbean

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

References

[1] Kumar D. and Rodge A.B. (2012) *J. Food Leg*., 25, 255-272.
[2] Rai P.S. and Dharmatti P.R. (2013) *Global J. Sci. Frontier Res. Agric. Vet*., 13, 1-5.
[3] Bhatt R.K., Jukanti A.K. and Roy M.M. (2017) *Legume Research*, 40 (2), 207-214.
[4] Kumar D. (2005) *Indian J. Agric. Sci*., 75, 375-391.
[5] Punia A., Yadav R., Arora P. and Chaudhary A. (2009) *J. Crop Sci. Biotech*., 12, 143-148.
[6] Tripathy S. and Das M.K. (2013) *J. Pharm. Scientific Innov*., 2, 24-28.
[7] Anonymous (2015-16) Directorate of economics and statistics, Pant Krishi Bhawan, Jaipur (Rajasthan) India.
[8] Jyani M., Sharma H. and Meera (2018) *International Journal of Agriculture Sciences*, 10 (7),5672-5675.
[9] Ali, M. (1998) *IPM system in Agriculture. Vol.4. Pulses (eds. R.K.Upadhyay, K.G. Mukerji and R.L.Rajak) Aditya Books Private Limited, New Delhi, pp* 1-40.
[10] Raguchander T. Rajappan K. and Prabakar K. (1995) *Journal of Biological Control*, 9, 63-64.
[11] Vidhyasekaran P. and Muthamilan M. (1995) *Plant Disease*, 79, 782-786.
[12] Lal S.S., Sachan L. (1987) *Plant Protection Association of India*, 185-201.
[13] Khaliq N., Virender K., Uma Shankar, Suheel A.G. and Norboo T. (2017) *International Journal of Current Microbiology and Applied Sciences*, 6(7),23442351.
[14] Fleming R., Retnakaran A. (1985) *Indian Journal of Economic Zoology*, 78-79.
[15] Henderson, C.F. and Tilton E.W. (1955) *J. Econ. Entomol*., 48, 157-161.
[16] Ashok Kumar C.T. and Shivaraju C. (2009) *Karnataka Journal of Agricultural Sciences*, 22(3),521-523.
[17] Deshmukh S.G., Sureja B.V., Jethva D.M., Chatar V.P. (2010) *Legume Research*, 33(4),269-273.
[18] Mallikarjuna J., Kumar C.T.A. and Rashmi M.A. (2009) *Karnataka Journal of Agricultural Sciences*, 22(3),617.
[19] Lal S. (1984) *Indian Farming*, 34(1), 3-4.
[20] Ishaaya I., Yablonski S., Mendelson Z., Mansour Y., Horowitz A.R. (1996) *Proceedings of the Brighton Crop Protection Conference, Pests and Diseases,* 3, 1013-1020.
[21] Ishaaya I, Damme N., Tirry L. (1998) *Proceedings of the Brighton Crop Protection Conference, Pests and Diseases*, 1, 49-50.

[22] Ishaaya I., Kontsedalov S., Horowitz A.R. (2003) *Archives of Insect Biochemistry and Physiology*, 54, 157-164.
[23] Hadapad A., Chaudhari C.S., Kulye M., Chandele A.G., Salunkhe G.N. (2001) *Journal of Nature Conservation*, 13, 137-140.
[24] Ishaaya I., Horowitz A.R. (1998) *Insecticides with Novel Modes of Action, Springer, Berlin, Germany*, 1-24.
[25] Ishaaya I., Kontsedalov S., Mazirov D., Horowitz A.R. (2001) *Mededelingen Faculteit Landbouwwetenschappen Rijksuniversiteit Gent*, 66, 363-374.
[26] Ishaaya I., Horowitz A.R., Tirry L., Barazani A. (2002) *Mededelingen Faculteit Landbouwwetenschappen Rijksuniversiteit Gent*, 67, 617-626.
[27] Kaushik A.K., Yadav S.K. and Srivastava P. (2016) *Annals of Plant Protection Sciences*, 24(1), 89-92.
[28] Sabahelkheir M.K., Abdalla A.H. and Nouri S.H. (2012) *ISCA J. Biol. Sci.*, 1, 67-70.
[29] Umbarkar P.S. and Parsana G.J. (2014) *Journal of Industrial Pollution Control,* 30(2), 227-230.
[30] Yadav N.K. and Singh P.S. (2014) *International Journal of Agriculture, Environment & Biotechnology*, 7(1), 187-190.