Effect of Weather Variables on Population of *Maruca Vitrata* (F.) and Efficacy of Different Insecticides Against Green Gram *Vigna Rediata L*

ABSTRACT

The present investigation was conducted during *Khrif* 2018 at Central Research Farm. SHUATS, Naini, Prayagraj. Experiment was laid out in randomized block design (RBD) with three replications and eight treatments including untreated plot. The activity of spotted pod borer was appeared during 32th SMW (0.61) and remained active till the 40th SMW the peak activity was observed on 37th SMW (9.88) larvae/ five plant. The correlation of revealed that the study showed a negative correlation with maximum and minimum temperature (r = -0.027^{NS} and 0.260^{NS}) strong positive correlation with rainfall (r = 0.789**) and negative correlation with wind velocity (r = 0.465^{NS}) respectively. Two applications of all selected insecticides molecules were evaluated against green gram spotted pod borer, *Maruca vitrata*. The highest percent pest reduction was recorded from chloropyriphos treated plot (69.60 %) followed by Cypermethrin (64.74 %), Imidacloprid (53.04 %), Quinalphos (47.26 %), Monocrotophos (46.06 %), Spinosad (40.96 %) and Indoxacarb (34.93 %) Among the treatment studied, the best and most economical treatment was Indoxacarb (1:2.24) followed by Spinosad 45SC (1:1.94), Monocrotophos (1:1.80), Chloropytiphos (1:1.75), Quinalphos (1:1.66), Imidaclopride (1:1.60), Cypermethrin (1:1.59) respectively.

Keywords: Benefit cost ratio, *Maruca vitrata*, Combination, Efficacy, Green gram, Seasonal Incidence.

1. Introduction.

Pulses are the cheap and best source of protein constituting about 27% of total dietary protein in our country. Pulses are third important group of crops in Indian agriculture after cereals and oilseeds. The use of pulses as food is concentrated in developing countries which account for about 90% of global pulse consumption. They maintain soil fertility through biological nitrogen fixation from environment by bacteria as *Rhizobium spp.* is prevalent in their root nodules Pulses crops. Availability of pulses has declined from 64 gm/capita/day to 32 gm/capita/day against the

W.H.O. recommendation of 80gm/capita/day (Nene. 2006). It is excellent green manure (1.5% N and easily decomposed when incorporated into soil). The nutritive value of mungbean is high approximately 25-28% protein, 1.0-1.5% oil, 3.5-4.5% fiber, 4.3-1.3% and, 62-65% carbohydrate, 9.1% water and Vitamins on dry weight basis (Singh *et al.* 2014) Insect-pests can attack mungbean at any stage from seedling to harvest but the crop is most susceptible from budding onwards. The effects of weather parameters on the incidence of insect pests provide suitable know how about the friendly weather conditions for development of insect pests, thus immensely helpful in formulating the management strategy against them (Tamang *et al.* 2017). Spotted pod borer, *M. testulalis* is the most formidable and potential pest cause extensive damage to green gram under field conditions. The low yield of green gram is attributed to the regular outbreaks of spotted pod borer, because of its extensive host range and destructiveness it became a persistent pest in green gram. It is reported that 20– 30 per cent pod damage in green gram is caused due to spotted pod borer (Zahid *et al.*, 2008) and most damaging pest during flower bud and also the post flowering stage (Atachi and Djihou 1994). The study aimed in order to find out the correlation of spotted pod borer, *M. testulalis* in greengram ecosystem with the weather parameters. Suitable understanding of the seasonal incidence of spotted pod borer is important due to variation in weather conditions and changing pod borer scenario on the green gram crop.

2. Methods and Materials

The experimental was conducted during *Kharif* 2018 at Central Research Field, Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Prayagraj, U.P. The green gram variety of GNG-1581 was sown in separate plot of 10×5m size. The distance of row to row 30cm and plant to plant 10 cm was respectively. The observation of seasonal incidence of *M. vitrata* was recorded at weekly interval from five randomly selected plant each line and to investigate the efficacy of different insecticides against *M. vitrara.* Experiment was laid out in randomized block design (RBD) with three replications and eight treatments including untreated plot. The treatments are Chloropyriphos @ 1.5 ml/lit (T1), Quinalphos @2ml/lit (T2), Cypermethrin @ 2ml/lit (T3), Imidacloprd @ 0.5ml/lit (T4), Monocrotophos @3ml/lit (T5), Indoxacarb @ 0.2 ml/lit (T6), Spinosad @ 0.4ml/lit (T7) and Untreated Plot (T8). The incidence of spoted pod borer was observed at ETL level of insect and spraying was done and observation was recorded at day before spray, 3rd day after spray, 7th days after spray and 14th days after spray after

each treatments. The analysis of variance (ANNOVA) technique was applied for calculation of the data and the calculated values for the compared the tabular values at 5% level of probability.

The following formula was used for calculating correlation coefficient:

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (\sum x)^2 . N\sum y^2 - (\sum y)^2}}$$

Whereas,

r = Simple correlation coefficient

x = Independent variables *i.e.* Abiotic components

y = Dependent variables *i.e.* pest

N = Number of observation

The following formula was used for the calculation of percent pest reduction:

$$1-\frac{\text{post treatment pest population treated plot}}{\text{Pre treatment pest population treated plot}} \times \frac{\text{pre treatmetnt pest population in control}}{\text{post treatment pest population in control}}$$

$$\text{B: C Ratio} = \frac{\text{Gross returns}}{\text{Total cost incurred}}$$

Where,

B: C Ratio = Benefit Cost Ratio

3. Result and Discussion

3.1 Effect of weather variables on population of *M. vitrata*

The sopted pod borer (*M. vitrata*) that attack on vegetative stage of the crop growth and observed at reproductive stage to till the maturity of the crop. The activity of spoted pod borer was appeared during 32th SMW (0.61) and remained active till the 40th SMW the peak activity was observed on 37th SMW (9.88) larvae/ five plant . The correlation of revealed that the study showed a negative correlation with maximum and minimum temperature (r = -0.027^{NS} and 0.260^{NS}) strong positive correlation with rainfall (r = 0.789**) and negative correlation with wind velocity (r = 0.465^{NS}) respectively. Present findings are also supported by the findings of (Bairwa and Singh 2017) who studied the population dynamics of *Maruca vitrata*, and reported that the correlation of was found positive and significant with rainfall.

Table1: Population dynamics of insect pest of *M. vitrata* in green gram during *Kharif season* 2018.

S. N.	SMW	Date of Observation	*M. Vitrata*	Temperature		RH	RF	WV
				Max.	Min.			
1	31	10.08.2818	0	32.2	25.8	86	0	2.3
2	32	17.08.2018	0.61	36.4	26.7	78	0	3.2
3	33	24.08.2018	1.42	33.4	24.3	87	11.4	2.1
4	34	31.08.2018	2.67	32.5	25.2	82	14.2	4.1
5	35	7.09.2018	4.89	31.9	26.4	75	34.7	3.4
6	36	14.09.2018	7.14	34.2	25.6	83	36	2.5
7	37	21.09.2018	9.88	31.4	24.9	88	21.3	1.3
8	38	28.09.2018	6.23	31.2	26.2	81	18.1	1.5
9	39	5.10.2018	2.15	30.7	23.4	88	9.3	1.8
10	40	12.10.2018	1.1	30.2	23.6	78	0	2.3
11	41	19.10.2018	0	30.1	23.9	79	1.2	4.1

SMW- Standard Meteorological Week, Max.- Maximum Temperature ºC, Min.- Minimum Temperature ºC, RH- Relative Humidity, RF- Rainfall (mm) and WV- Wind Velocity (km/hr.)

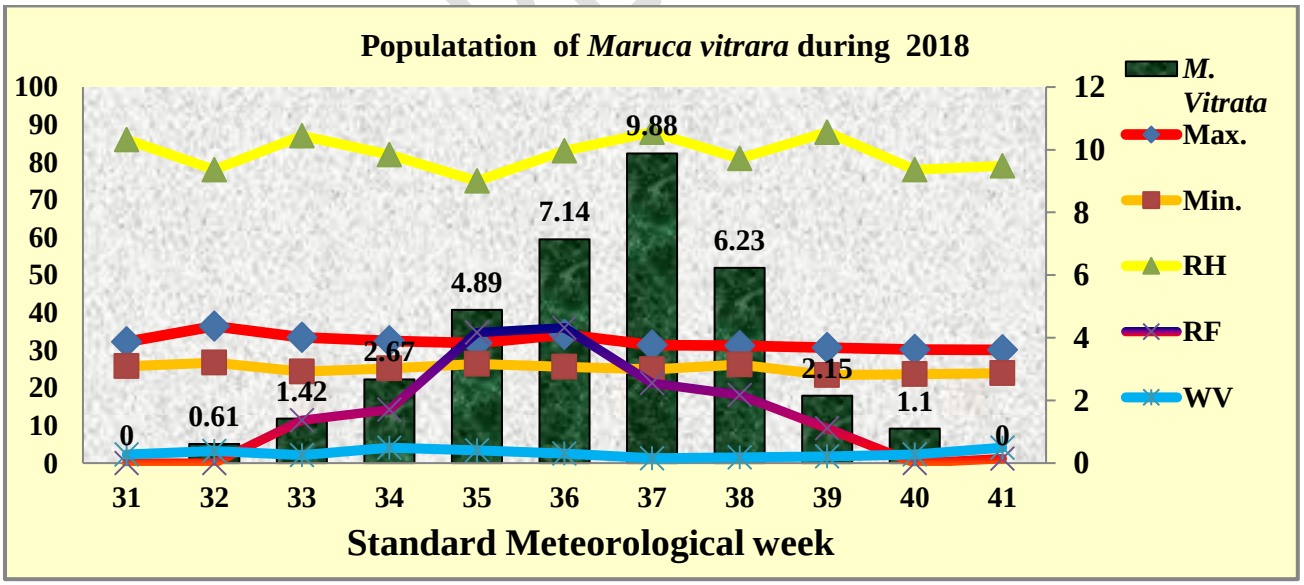

Fig. 1 Spoted pod borer (*M. vitrara*) *vs.* weather variables.

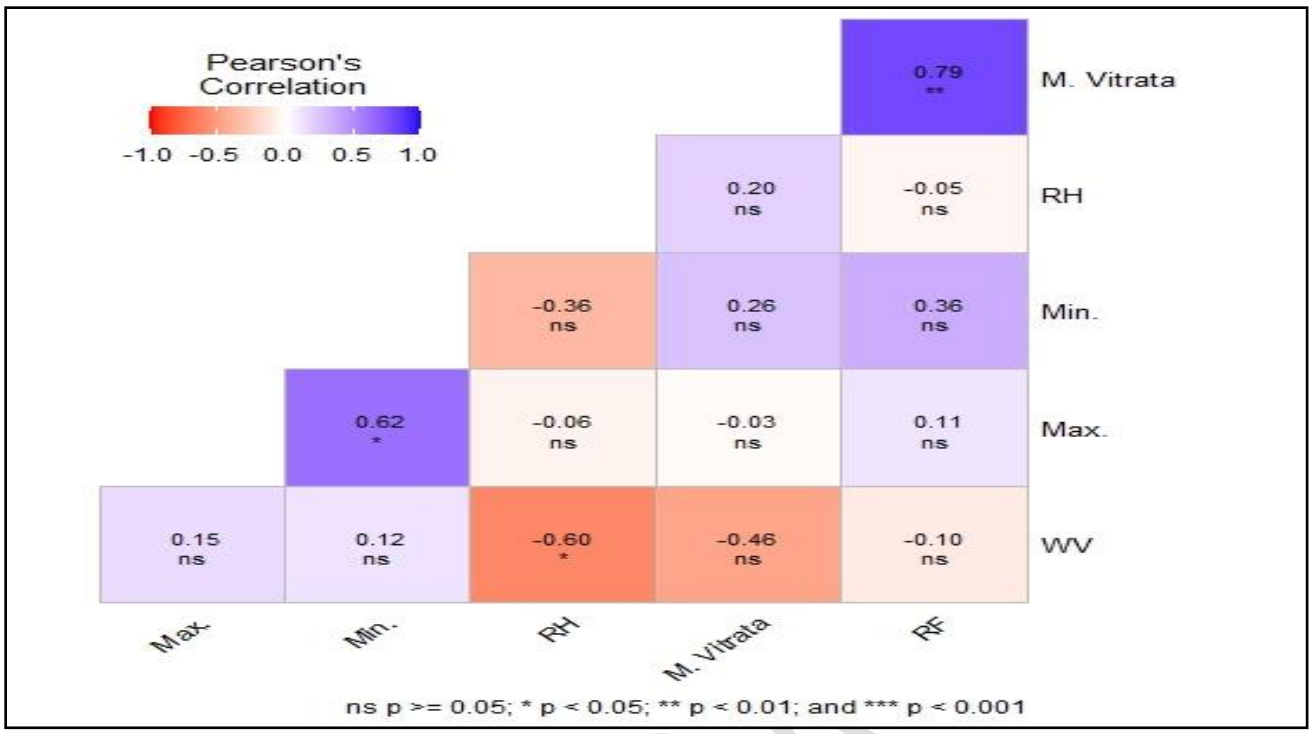

Fig. 2 Pearson's correlation *M. vitrata vs.* weather variables

3.2 Effect of insecticides molecules on percent pod damage

All insecticides molecules were significant and superior over control (Table 2). The mean data of 3rd days 7th days and 14th days larval population after first spray revealed that the treatments expected control are effective and at par. Among the all treatments highest percent pest reduction of greengram spoted pod borer was recorded in Chloropyriphos @ 1.5 ml/li (T1) (70.10) treated plot followed by Cypermethrin @ 2ml/lit (T3) (67.03), Imidacloprd @ 0.5ml/lit (T4) (50.77), Quinalphos @ 2ml/lit (T2) (47.73), Monocrotophos @ 3ml/lit (T5) (47.43), Spinosad @ 0.4ml/lit (T7) (37.13), and Indoxacarb @ 0.2 ml/lit (T6) (36.97) respectively. The data of larval population of greengram spoted pod borer over the control after second spray revealed that all the treatments were significantly superior over control. Among all the treatments mean data of percent pest reduction were found Chloropyriphos @ 1.5 ml/lit (T1) (69.10) treated plot followed by Cypermethrin @ 2ml/lit (T3) (55.80), Imidacloprd @ 0.5ml/lit (T4) (55.33), Quinalphos @ 2ml/lit (T2) (46.77), Monocrotophos @ 3ml/lit (T5) (44.74), Spinosad @ 0.4ml/lit (T7) (44.47), and Indoxacarb @ 0.2 ml/lit (T6) (32.90) respectively.

Table 2: Bio-efficacy of insecticides molecules against pod borer in green gram after first spray.

Treatments	No. of larvae/plant before spray	Percent pest reduction indicated day after first spray			
		3 DAS	7 DAS	14 DAS	Mean

T1	Chloropyriphos @ 1.5 ml/lit	3.20	49.60	73.70	87.00	70.10
T2	Quinalphos @2ml/lit	3.40	34.30	49.90	59.00	47.73
T3	Cypermethrin @ 2ml/lit	3.42	51.40	69.40	80.30	67.03
T4	Imidacloprd @ 0.5ml/lit	3.00	37.00	53.30	62.00	50.77
T5	Monocrotophos @3ml/lit	4.02	35.20	48.20	59.80	47.43
T6	Indoxacarb @ 0.2 ml/lit	3.80	25.30	38.80	46.80	36.97
T7	Spinosad @ 0.4ml/lit	3.60	23.50	38.00	49.90	37.13
T8	Control	3.86	0.00	0.00	0.00	0.00
	F- Test		S	S	S	S
	S. Ed.		1.10	1.91	2.58	2.32
	C.D.(P=0.05)		2.36	4.09	5.53	4.97

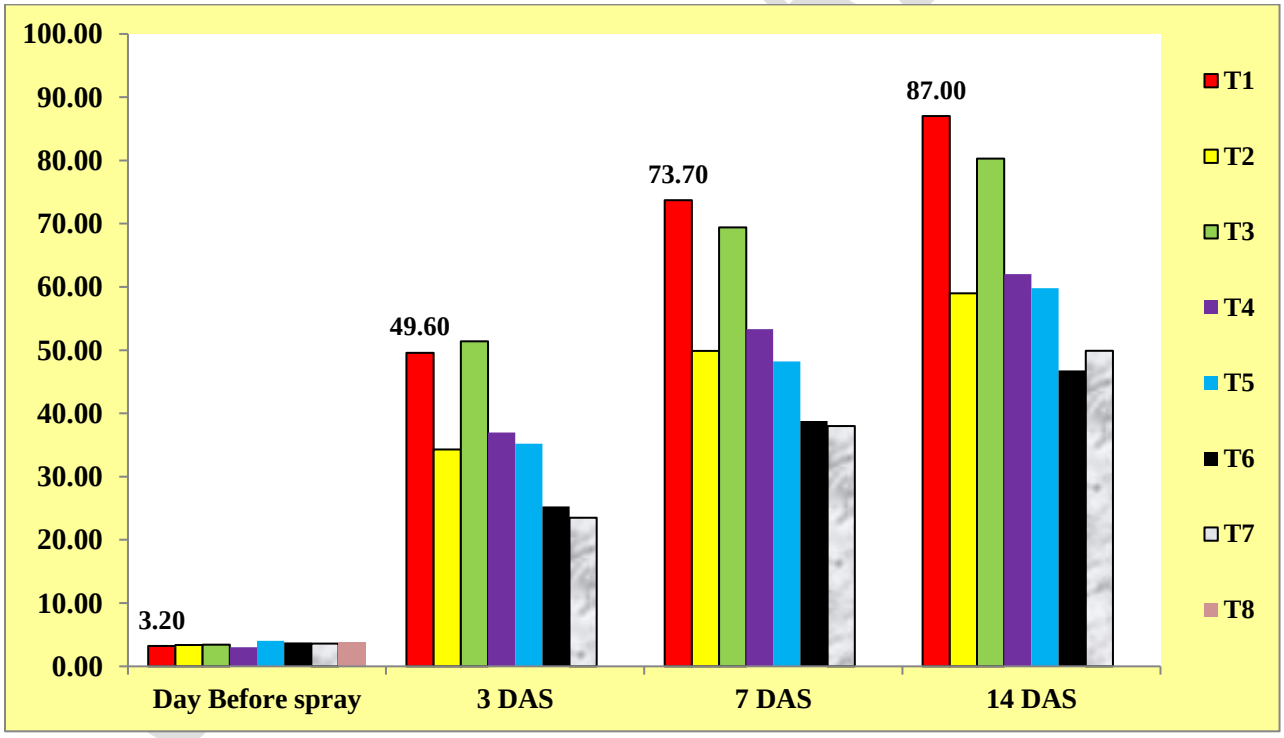

Fig. 3: Effect of different insecticides molecules on percent pest reduction after first spray.

Table 3: Bio-efficacy of insecticides molecules against pod borer in green gram after second spray.

	No. of	**Percent pest reduction indicated day after**

Treatments		larvae/plant before spray	second spray			
			3 DAS	7 DAS	14 DAS	Mean
T1	Chloropyriphos @ 1.5 ml/lit	3.06	45.50	73.80	88.00	69.10
T2	Quinalphos @2ml/lit	3.20	30.90	49.11	60.30	46.77
T3	Cypermethrin @ 2ml/lit	3.26	38.20	47.20	82.00	55.80
T4	Imidacloprd @ 0.5ml/lit	4.20	37.30	55.80	72.90	55.33
T5	Monocrotophos @3ml/lit	3.70	30.00	46.70	56.50	44.74
T6	Indoxacarb @ 0.2 ml/lit	3.20	19.10	33.60	46.00	32.90
T7	Spinosad @ 0.4ml/lit	4.00	23.60	62.32	48.30	44.40
T8	Control	3.92	0.00	0.00	0.00	0.00
	F- Test		S	S	S	S
	S. Ed.		0.87	1.15	2.75	3.17
	C.D.(P=0.05)		1.86	2.47	5.90	6.8

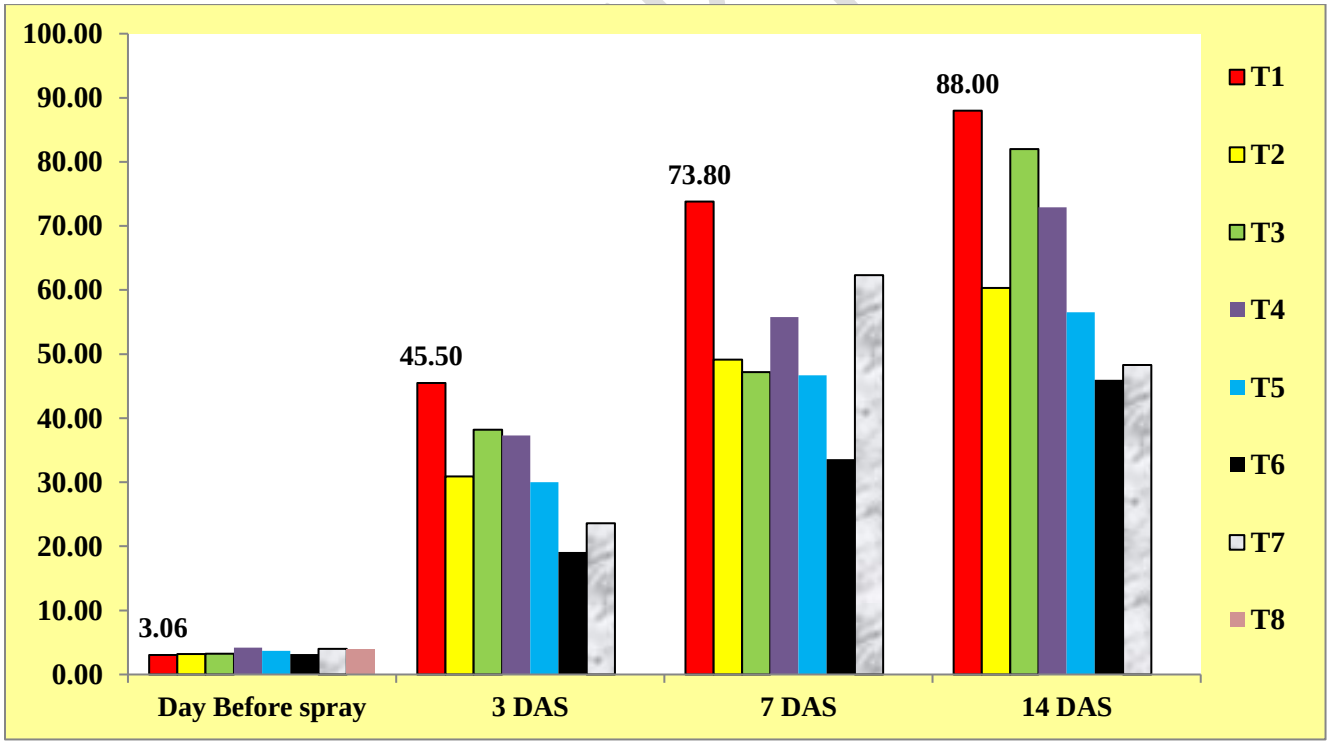

Fig. 4: Effect of different insecticides molecules on percent pest reduction after second spray.

According to overall mean of percent pest reduction after first spray and second spray revealed all the treatments highest percent pest reduction was found in Chloropyriphos @ 1.5 ml/li (T1) treated

plot (69.60 %) similar finding were reported by Reddy and Prasad (2014) followed by Cypermethrin @ 2ml/lit (T3) (47.26 %) similar finding by (Umbarkar and Parsana 2014), Imidacloprd @ 0.5ml/lit (T4) (53.04) larval reduction and also similar were reported by (Mandal *et al.,* 2013) mean larval reduction by Spinosad @ 0.4ml/lit (T7) (40.96 %) similarly reported by Kumar and (Shivaraju 2009) noticed (44.68 %) reduction of *M. vitrat*a Spinosad treated plot. The mean percent reduction of Quinalphos treated plot is (47.26 %). similar finding also (Kaushik *et al.,* 2016) and Indoxacarb treated plot (34.93 %) similar findings were also (Bairwa and Singh 2015) reported that indoxacarb treated plot shown (36.66) percent pest reduction of *M. vitrata* respectively.

Table 4: Economics of insecticides evaluated against spotted pod borer in green gram.

Name of Treatments	Cost of Insecticides	Common Cost	Total cost	Yield q/ha	Gross return	Net return over control	C:B Ratio
T1 Chloropyriphos	1620	43036	44656	11.04	78384	14839	1:1.75
T2 Quinalphos	1600	43036	44636	10.48	74408	10863	1:1.66
T3 Cypermethrin	1840	43036	44876	10.05	71355	7810	1:1.59
T4 Imidacloprd	1100	43036	44136	10.00	71000	7455	1:1.60
T5 Monocrotophos	1950	43036	44986	11.44	81224	17679	1:1.80
T6 Indoxacarb	1090	43036	44126	13.98	99258	35713	1:2.24
T7 Spinosad	1256	43036	44292	12.12	86052	22507	1:1.94
T8 Control	0	43036	43036	8.95	63545	0	1:1.47

3.3 Benefit Cost Ratio (BCR):

The highest yield was recorded in T6- Indoxacarb (13.98 q/ha), T7- Spinosad (12.12q/ha), T5- Monocrotophos (11.44 q/ha), T1- Chloropyriphos (11.04 q/ha), T2- Quinalphos (10.48 q/ha), T4- Imidacloprid ((10.00q/ha), T3- Cypermethrin (10.05 q/ha) and Control (8.95 q/ha). The treatments Indoxacarb (13.98) was highest effective among all treatments. Similar yield was reported Yadav and Singh (2014) that the maximum yields was recorded in treatment Indoxacarb (11.8 q/ha) Followed by Spinosad (11.08 q/ha).

The benefit cost ratio worked out, interesting result was achieved, among the treatments studied, the best treatment T6- Indoxacarb (1:2.24) followed by T7-Spinosad (1:1.94), T5-

Monocrotophos (1:1.80), T1- Chloropyriphos (1:1.75), T2- Quinalphos (1:1.66), T4- Imidacloprid (1:1.60) and T3 Cypermethrin (1:1.59). The highest benefit ratio was found in Indoxacarb treatment (1:2.24) similar finding Mandal *et al.,* (2013)

4. Conclusion

The result obtained from this study demonstrates that the activity of spoted pod borer was appeared during 32th SMW (0.61) and remained active till the 40th SMW the peak activity was observed on 37th SMW (9.88) larvae/ five plant . The correlation of revealed that the study showed a negative correlation with maximum and minimum temperature (r = -0.027^{NS} and 0.260^{NS}) strong positive correlation with rainfall (r = 0.789**) and negative correlation with wind velocity (r = 0.465^{NS}) respectively. The Chloropyriphos was the most effective in managing *M. vitrata* in greengram through reducing larval population, pod damage and the higher incremental cost benefit ratio was observed from Indoxacarb 1:2.24 respectively.

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