ISSN 0258-7122
Bangladesh J. Agril. Res. 34(2) : 303-311, June 2009

EFFECTS OF SEED TREATMENT AND SOIL APPLICATION WITH SOME INSECTICIDES ON STEMFLY AND POD BORERS ON MUNGBEAN

M. A. ZAHID[1], M, A. I. SARKER[2], M. M. ISLAM[3]
M. A. HOSSAIN[4] AND M. R. BEGUM[5]

Abstract

For controlling stemfly *(Opheoniyia phaseoli)* and pod borers *(Helicoverpa armigera & Maruca vitrata* of mungbean insecticides *Carbofuran,* Carbosulfan, and Phenyl Pyrazol were applied as seed treatment and soil application during *kharif* II season (August to December) in 2004 and 2005 at Burirhat, Rangpnr. In two years, stemfly infested 86.67-93.33 percent rnunghean plants and caused 26.90-27.09 percent stem tunneling in untreated plots. Carbofuran in both seed treatment and soil application had similar effect on stemfly resulting 1.4 to 7.0 and 1.4 to 4.57 times less damage and stem tunneling, respectively, than the control. Pod borer damage did not differ significantly among the treatments in 2004, but differed in the second year. The yield of mungbean was significantly higher by the soil application of Corbofuran followed by the seed treatment by the same insecticides. But soil application of Carbofuran proved to be economical.

Key Words: Seed treatment, soil application, insecticides, stemfly and pod borers, mungbean.

Introduction

Munghean is an important pulse crop grown in Bangladesh for its high price, easy digestibility, good flavour and high protein content. It occupies about 10% of the total area under pulses and contributes 8.5% of the total pulse production in the country (BBS, 2004).

Munghean is severely damaged by a number of insect pests. Among them, stemfly *(Opheomyia phaseoli)* and pod borers *(Helicoverpa armigera & Maruca vitrata,.)* are considered to he major pests. Insecticides are usually applied as foliar application for the control of these pests. An attempt was made to evaluate the relative efficacy of some insecticides as seed treatment and soil application against these pests.

Materials and Method

The experiments were conducted at Agricultural Research Station, Burirhat, Rangpur during the cropping seasons of mungbean from August to December of

[1-3]Scientific Officer, ARS, BARI, Burirhat, Rangpur, [4]Senior Scientific Officer, RARS, BARI, Ishurdi, Pabna, [5]Secior Monitoring Officer, RDRS, Rangpur, Bangladesh.

2004 - 05 and 2005 - 06. The investigation was made to find out the most effective insecticides in seed treatment and soil application for controlling the stemfy and pod borers of mungbean. Carbofuran 5 (3 (Furadan 5G). Carbosulfan 6G (Marshal 6G) and Phenyl Pyrazol 3G (Regent 3G) @ 2 and 4 % were used in seed treatment and the same insecticides at 0.75 and 1kg a.i. /ha were applied in the soil with untreated control.

The experiments were laid out in RCBD with three replicates. The unit plot size was 3m x 2.1m with an inter-plot distance of Im and inter block distance of 1.5m. The spacing was 30cm between rows and 10cm between plants. For seed treatments, required quantity of insecticides was mixed with ample water to prepare slurry with which seeds were treated (Sinha *et al.,* 1993). The granules for soil application were applied in the soil below the seed furrows at the time of sowing. At harvest, 10 randomly selected plants from each plot were uprooted and stems were split opened by a scalpel for recording the extent of stem tunneling by stemfly. The lengths of the stem were measured by a scale. From these data, percentage of stemfly infested plants and percentage of stem tunneling were calculated. Percent stem tunneling was calculated by following way —

$$\text{Stem tunneling (\%)} = \frac{\text{Length of stem tunneling}}{\text{Total length of stem}} \times 100$$

Numbers of pod borer infested pods were also counted at harvest. The yield of rnunghean seeds was recorded. Finally the data were analyzed statistically by using MSTAT programme and compared by DMRT. Correlation regression analysis was done to determine the relationship between stem tunneling and yield of mungbean as affected by each insecticidal treatment.

Results and Discussion

Stemfly infestation: The data presented in Table 1 and 2 show that the percentage of stem fly, infested plants in the treated plots were significantly lower than the control. In 2004, the soil application of Carbofuran @ 0.75 kg and 1 kg a.i./ha recorded the least plant damage (20%) by stemfly and the seed treatment with 2 and 4 % Carbofuran resulted 40% damage, which was double than in soil treatment. In 2005, seed treatment with Carbosulfan (2%) showed the least damage (13.33%) followed by (33.33 %) with Carbosulfan (4%) and Carbofuran (2%) and (4%), respectively. Highest percentage (86.67 - 93.33 %) of stemfiy infestation was obtained from the untreated control plots in both the years (Table 1 & 2). Bear *et al.* (1993) reported that Carhofuran and Phorate at 0.75 and 1kg a.i./ha were the most effective insecticide against *Opheomyia phaseoli* in peas. The effectiveness of soil application of Carbofuran against stem fly has also been reported by Ambekar *et al.* (1984) and Ramadoss & Sivaprakasam (1988).

Stem tunneling by stemfly: The larvae of stemfly made tunnel by feeding inside the stem of munghean plant. Percentage of stem tunneling was found to be major

factor for yield reduction by stemfly. The stem tunneling in plants varied significantly ($p<0.05$) due to the application of insecticides. In 2004, the lowest stem tunneling (5.92 %) was obtained from the plants of Carhofuran (1kg a.i./ha) treated plot followed by Carbofuran (0.75 kg a.i./ha). The seed treatment with Carbofuran (2% and 4%) recorded the same level of stem tunneling, which was significantly higher than that of its soil application (Table 1). In 2005, slight difference of stem tunneling was found. Soil application of Carbofuran at l kg a.i./ha recorded the least stem tunneling (7.86 - 10.33 %) followed by the seed treated with Carbofuran (2%) (Table 2). The highest stem tunneling at 26.90 to 27.09 percent was found in the control plots in both the years (Table 1 & 2). According to Hussain (1978) Carbofuran granules as soil application significantly reduced the damage of stemfly infestation. Zahid and Sardar (2005), however, reported soil application of Carbofuran and Carbosulfan was the effective measure to control stemfly and pod borers on blackgram. Similar results that with Carbofuran granules were obtained by Babu and Rajsaekaran (1981) and Gupta & Singh (1984). Saxena *el al.* (1975) reported effective control with Carbofuran seed treatment. Sinha *et al.* (1993) reported that both seed treatment and soil application of Carbofuran was quite effective against stemfly *(Melanagromyzu phuseoli).* In the present study, Carbofuran granules both seed treatment and soil application proved effective in controlling the stemfly.

Table 1.Treatrnent of insecticides on the incidence of stemfly, pod borers and yield of munghean during 2004-2005.

Treatment	Stemfly infected plants at harvest (%)	Stem tunneling at harvest (%)	Pod borers infestation (%)	Grain yield (kg/ha)
Seed treatment				
Carbofuran (2%)	40.00 d	8.24 cde	1 7.03	925 b
Carbofuran (4%)	40.00 d	8.07 cde	1 7.90	945 b
Carbosulfan (2%)	53.33bc	12.O7bcde	18.14	846c
Carbosulfan (4%)	53.33bc	12.05 hcde	17.45	864c
Phenyl pyrazol (2%)	53.33 bc	13.05 bed	19.22	822ed
Phenyl pyrazol (4%)	46.67cd	11.99bcde	17.85	815cd
Soil application				
Carbofuran @ 0.75 kg a.i./ha	20.00 e	6.75 de	16.96	I 245 a
Carbofuran @ 1 kg a.i./ha	20.00 e	5.92 e	16.86	1294 a
Carbosulfan @ 0.75 kg a.i./ha	53.33b	13.48bc	18.09	776cd
Carhosulfan @ 1 kg a.i./ha	60.00 b	14.92 b	18.54	704 d
Phenyl pyrazol @ 0.75 kg a.i /ha	53.33bc	12.l6bcde	19.21	822cd
Phenyl pyrazol @ 1 kg a.i /ha	53.33bc	11.39bcde	18.81	839c
Control	86.67 a	27.09 a	22.15	546e

In a column means followed by common letter (s) are not significantly different at 5% level.

Pod damage by the borers: The caterpillars of *H. armigera* feed on leaves, buds, flowers, and voraciously on pods. The caterpillars of *Maruca vitrata* damage flower buds, flower, and developing pods. As for pod borer damage, the data presented in Table 1 show that insecticidal treatment did not differ significantly compared to the control in 2004, but there was significant difference (9.64-13.27 %) in 2005 (Table 2). Seed treatment and soil application of granular insecticides did not affect on pod borer damage on mungbean as stemfly infestation. This was due to not effectiveness of granular insecticides in both seed treatment and soil application on the pod borer attack. It might be due to pod borers attack to mungbean in the flowering and pod formation stage. Sahoo and Senapati (2000) reported that *H. armigera* was observed in the flowering stage and *M. testulalis* was the dominant pest in the grain filling stage in pigeonpea. The highest activity of pod borer was during pod formation stage in chickpea (Metho and Singh, 1983). To reduce pod borers attack, spray schedules should be made at flower initiation and pod formation stages.

Table 2. Treatment of insecticides on the incidence of stemfly, pod borers and yield of munghean during 2005-2006.

Treatments	Stemfly infected plants at harvest (%)	Stem tunneling at harvest (%)	Pod borers infestation (%)	Grain yield (kg/ha)
Seed treatment				
Carbofuran (2%)	33.33 cd	9.83 de	11.42 b	1027 b
Carbofuran (4%)	33.33 cd	8.33 e	13.20 b	1250 a
Carbosulfan (2%)	13.33 d	13.60 cd	10.53 b	959 bed
Carbosulfan (4%)	33.33 cd	14.53 c	9.64 b	83 bcde
Phenyl pyrazol (2%)	60.00 abc	15.81 c	10.90 b	843 de
Phenyl pyrazol (4°/o)	60.00 abc	14.96 c	11 .50 b	862 ede
Soil application				
Carbofuran @ 0.75 kg a.i./ha	53.33 be	8.16 e	11.54 b	1050 b
Carbofuran @ 1 kg a.i./ha	60.00 abc	7.86 e	0.21 b	11267 a
Carbosulfan @ 0.75 kg a.i./ha	66.66 abc	16.90 be	10.73 b	850 de
Carhosulfan @ 1 kg a.i./ha	60.00 abc	19.38 b	9.88 b	805 e
Phenyl pyrazol @ 0.75 kg a.i /ha	73.33 ab	15.66 c	11.91 b	827 de
Phenyl pyrazol @ 1 kg a.i /ha	66.66 abc	16.16 c	13.27 b	820 de
Control	93.33 a	26.90 a	27.71 a	557 f

In a column means followed by common letter (s) are not significantly different at 5% level.

Table 3. Economic evaluation of insecticides on grain yield of mungbean based on benefit cost ratio (BCR) during 2004-05.

Treatments	Quantity of insecticides (kg/ha)	Cost of insecticides (Tk.)	Labour charge (Tk.)	Total cost (Tk.)	Total yield (kg/ha)	Additional yield over control (kg/ha)	Cost of additional yield (Tk.)	Net profit (Tk.)	BCR
Seed treatment									
Carbofuran (2%)	2.3	276	480	756	925	379	13265	12509	16.54
Carbofuran (4%)	4.6	552	480	1032	945	399	13965	12933	12.53
Carbosulfan (2%)	2.3	276	480	756	822	300	9660	8904	12.88
Carbosulfan (4%)	4.6	552	480	1032	864	318	11130	10098	9.78
Phenyl pyrazol (2%)	2.3	276	480	756	846	276	10500	9744	11.77
Phenyl pyrazol (4°/o)	4.6	552	480	1032	815	279	9765	8733	8.46
Soil application									
Carbofuran @ 0.75 kg a.i./ha	15	1800	480	2280	1245	699	24465	22185	9.73
Carbofuran @ 1 kg a.i./ha	20	2400	480	2880	1294	748	26180	23300	8.09
Carbosulfan @ 0.75 kg a.i./ha	12.5	1500	480	1980	776	230	8050	6070	3.06
Carhosulfan @ 1 kg a.i./ha	16.66	1999	480	2479	704	158	5530	3050	1.23
Phenyl pyrazol @ 0.75 kg a.i /ha	25	3000	480	3480	822	275	9660	6180	1.77
Phenyl pyrazol @ 1 kg a.i /ha	33.33	3999	480	4479	839	293	10255	5775	1.28
Control	-	-	-	-	546	-	-	-	-

Mungbean = Tk. 35/kg
Furadan (Carbofuran) 5G = Tk. 120/kg
Marshal (Carbosulfan) 6G = Tk. 120/kg
Regent (Pheyl phrazol) 3G = Tk. 120/kg
Labour charge = Tk. 120/Labour

Mungbean yield and economic evaluation of insectidial treatments: Yield of munghean seed or grain obtained from the treated insecticides against stemfly and pod horers differs significantly ($p<0.05$) (Table l and 2). In 2004, grain yield of mungbean was the highest from 1245 kg/ha to 1294 kg/ha in the plot treated with soil application of Carbofuran @ 0.75 and 1 kg a.i.//ha. The seed treatment with the same insecticide (2% and 4%) showed the yield ranged from 925 kg/ha to 945 kg/ha next to soil application of Carbofuran and which was statistically similar (Table 1). In 2005, the highest yield of 1267 kg/ha was found in soil application of Carhofuran (1 kga.i./ha), which was statistically similar (1250 kg/ha) to seed treatment with Carhofuran (4%). Seed treated with Carbofuran (2%) showed the yield (1027 kg/ha) next to the seed treatment with (Carbofuran (4%) followed by (1050 kg/ha) the soil application of Carbofuran (0.75 kg a.i./ha) (Table 2). The treated plots showed 21 or 57% and 30 to 56 % yield increase over control in 2004 and 2005, respectively. Babu and Rajasekaran (1981) evaluated seven insecticides against *0. Phuseoli* on cowpea of which soil application of Carbofuran 5G @ 1 kg a.i./ha at the time of sowing reduced stemfly infestation and increased the yield. Singh *et al.* (1988) also reported the similar result on pea. Shinha *et al.* (1993) reported that productivity of pea was the maximum under the treatment with Carbofuran (@ 2% and 4%) and soil

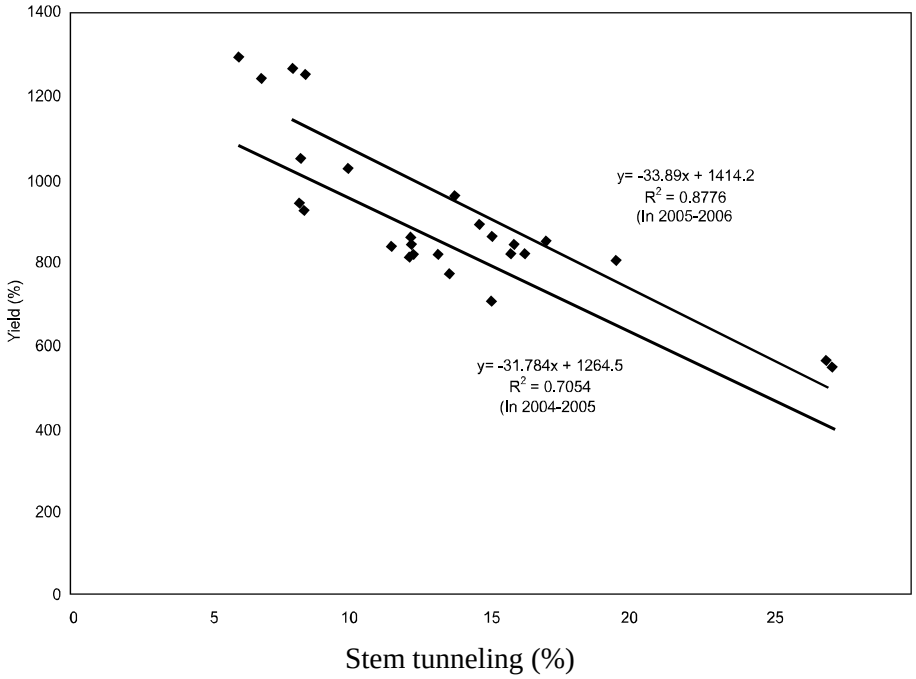

Fig. 1. Relationship between stem tunneling and yield of mungbean treated with different insecticides against stemfly in 2004-2005 & 2005-2006.

Table 4. Economic evaluation of insecticides on grain yield of mungbean based on benefit cost ratio (BCR) during 2005-06.

Treatments	Quantity of insecticides (kg/ha)	Quantity of insecticides of 2 sprays (L)	Cost of insecti-cides (Tk.)	Labour charge (Tk.)	Total cost (Tk.)	Total yield (kg/ha)	Additional yield over control (kg/ha)	Cost of additional yield (Tk.)	Net profit (Tk.)	BCR
Seed treatment										
Carbofuran (2%)	2.3	0.5	826	720	1546	1027	470	16450	14904	9.64
Carbofuran (4%)	4.6	0.5	1102	720	1822	1250	693	24255	22403	12.29
Carbosulfan (2%)	2.3	0.5	826	720	1546	959	400	14000	12454	8.05
Carbosulfan (4%)	4.6	0.5	1102	720	1822	893	336	11760	9938	5.45
Phenyl pyrazol (2%)	2.3	0.5	826	720	1546	843	286	10010	8464	5.47
Phenyl pyrazol (4°/o)	4.6	0.5	1102	720	1822	862	305	10675	8853	4.85
Soil application										
Carbofuran @ 0.75 kg a.i./ha	15	0.5	2350	720	3070	1050	493	17255	14185	4.62
Carbofuran @ 1 kg a.i./ha	20	0.5	2950	720	3670	1267	710	24850	21180	5.77
Carbosulfan @ 0.75 kg a.i./ha	12.5	0.5	2050	720	2770	850	293	10255	7485	2.70
Carhosulfan @ 1 kg a.i./ha	16.66	0.5	2549	720	3269	805	248	8680	5411	1.65
Phenyl pyrazol @ 0.75 kg a.i /ha	25	0.5	3550	720	4270	827	270	9450	5180	1.21
Phenyl pyrazol @ 1 kg a.i /ha	33.33	0.5	4500	720	5270	820	263	9205	3935	0.74
Control	-		-	-	-	557	-	-	-	-

Mungbean = Tk. 35/kg
Furadan (Carbofuran) 5G = Tk. 120/kg
Marshal (Carbosulfan) 6G = Tk. 120/kg
Regent (Pheyl phrazol) 3G = Tk. 120/kg
Ripcord (Cypermethrin) 10 EC = Tk. 1100/L
Labour charge = Tk. 120/Labour

treatment with *(Carhofuran* (1 kg a.i./ha). According to Zahid and Sardar (2005), Carbofuran and Carbosulfan granules as soil application significantly reduced the damage of stemfly and pod borers and produced maximum yield in blackgram. This evidence supported the increased yield of munghean in the present study by the seed treatment and soil application of Carbofuran and Carbosulfan. This result also shows that there is a significant negative correlation and linear relationship between stem tunneling and yield (Fig. I). It indicated that the reduction of yield is associated with an increase in stem tunneling. Therefore, mungbean crop should be controlled from stemfly during early growth stage to avoid yield reduction. R^2 = 0.7054 (2004 — 2005) and 0.8776 (2005 2006) are also significant in both years (Fig. 1).

In 2004, the highest BCR (16.54) was obtained from seed treatment with Carhofuran (2%) followed by (12.88) seed treatment with Carbosulfan (2%). In 2005, the highest BCR (12.29) was obtained from the seed treated with Carbofuran (4%) followed by (9.64) the seed treated with Carhofuran (2%). Seed treatment with Carbofuran (2 %) and Carbosulfan (2%) were also proved quite economical in 2004 and 2005, respectively. Sinha *et al.* (1993) evaluated Carhofuran and Phorate as soil and seed treatments for the control of *Melanagromyza phaseoli (L)pheomyia phaseoli)* on peas. Seed treatment with both insecticides at 2 and 4 % was effective against the pests and more economical than soil treatment. The maximum cost benefit ratio was obtained from seed treatment with 2 % Carbofuran.

References

Ambekar. J. S., M. E. Patil, D. B. Pawer, D. N. Gandhale and R. N. Pokharkar. 1984. A note on the control of stemfly *(Opheomyia phaseoli* Tryon) on peas (*Pisum sativum* L). *South Indian Hort.* 32 (6): 377-378.

Babu. P. C. S. and B. Rajasekaran. 1981. A note on the control of stemfly. *Ophiomyia phaseoli* on cowpea, (*Vigna uguculata* L.). *Madras Agric. J.* **68** (3): 205-206.

Bangladesh Bureau of Statistics (BBS). 2004. Statistical Yearbook of Bangladesh. Ministry of Planning, Government of People's Republic of Bangladesh, Dhaka. p 141.

Bear, K. S., G. S. Dhillon, M. Singh. and M. Singh. 1993. Control of pea stemfly. *Opheomyia phaseoli* Tryon in early crop of pea. *Indian J. Ent.* **55** (2): 210 211.

Gupta. P. K. and J. Singh. 1984. Control of *Ophiomyia phaseoli.* in green gram with granular insecticides. *Indian, J. Agric. Sci.* **54** (4): 3210.

Hussain, M. M .D. 1978. Soil application of granules to control bean fly *(Ophiomyia phaseoli.* Agromycidae. Diptera) infesting Mean *(Phaseolus vulgaris.* L.) in Maharashtra. *J. Moharastra Agril. Univ.* **20** (1): 83-84.

Metho, D. N. and K. M. Singh. 1983. Succession of insect pests in chickpea. *(Ccer arirtinum* Linn. *Indian J. Entomol.* **45** (4): 377-383.

Rarnadoss, S. and K. Sivaprakasam. 1988. Control of root rot (Macrophomina *phuseolina)* and *(Opheomyia phaseoli* Tryon) on cowpea. *Madras Agric. J.* **75** (3 4): 133-138.

Saxena. H. P.. A. Phokela and Y. Singh. 1975. Effectiveness of Carbofuran as seed treatment for controlling pest complex of mung (*Phaseolus aureus)* and *(Phaseolus vulgaris). Entomologist's Newsl.* ***6*** (14): 27 — 28.

Shahoo. B. K. and B. Senapati. 2000. Relative abundance of pod borer species in different maturing pigeon pea varieties in costal belt of Orissa. *Indian J. Plant Prot.* **28** (2): 192-994.

Singh. H. M., S. M. A. Rizivi, R. Singh and R. Singh. 1988. Insectidal control of pea stemfly, *Ophiomyiaph phaseoli.* (Tryon). *Indian J. Plant Prot.* **16** (1): 4 1-43.

Sinha, M. M., S. F. Hameed, D. N. Metito and B. S. Jha. 1993. Effectiveness of seed and soil treatment with some insecticides against stemfly, *Melanagromyza phaseoli* and pod borer, *Etiella zinckenella* T. on pea *(Pisum sativum* L.). *Indian J. Ent.* **55** (3): 297-302.

Zahid. M. A. and M. A. Sardar. *2005.* Effect of some insecticides and sowing times for the control of stemfly and pod borers in blackgram, *Bangladesh. J. Agril. Res.* **30** (3): 395-404.