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Integrated management of flower thrips and pod borers of mungbean using blue sticky trap and insecticides

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ABSTRACT

Effectiveness of integrated management approaches using blue sticky trap, bio and synthetic insecticides were evaluated against flower thrips and pod borers of mungbean during kharif-I of 2020, 2021 &2022. All of the management packages significantly reduced flower infestation by thrips, thrips population and pod borer infestation in mungbean. The lowest percentage of flower infestation (23.33%) was found in IPM package-3: (Blue sticky trap + two spraying of chlorfenapyr (Intrepid 10 EC) @ 1 ml/l at 100% flowering and 100% podding stage + third spraying with Emamectin Benzoate (Proclaim 5 SG) @ 1 g/l at seed developing stage) which was similar with other IPM packages and farmers practice. The lowest percentage of pod borer infestation was observed in IPM package-2: (Blue sticky trap + two spraying of Bio-Chamak (Celastrus angulatus 1% EW) @ 2.5 ml/l at 100% flowering and 100% podding stage + third spraying with spinosad (Success 2.5 EC) @ 1.2 ml/l at seed developing stage) which was also similar with other IPM packages and farmers practice. The highest yield and additional return come from IPM package followed by farmer's practice. But the highest benefit (MBCR 4.07) comes from farmers practice. This might be due to higher cost of IPM components brought down the profit margin and showed the lower MBCR than that of farmers practice. Although IPM packages under this study are not financially profitable as farmers practice but considering environment friendliness, the IPM package-2 might be useful for controlling flower thrips and pod borers of mungbean with higher yield in the insects prone cropping areas without harming the ecosystem.

Key words: mungbean, flower thrips, pod borers, blue sticky trap and integrated management

INTRODUCTION

Mungbean (*Vigna radiata L.*) is one of the important pulse crops in Bangladesh. It is grown mainly in the late rabi season in southern regions after harvesting of Aman rice and in north western, mid-western and south-western region of Bangladesh (Hossain *et al.,* 2020). It grows in kharif-I season after harvesting of rabi crops. Due to availability of short duration varieties, farmers are becoming more interested to cultivate this valuable pulse crop (Hossain *et al.,* 2020).But due to the attack of insect pests especially in the flowering and podding stage cause significant yield loss (Hossain, 2014).More than twelve species of insect pests were found to infest mungbean in Bangladesh (Rahman *et al*., 2000). Among them, flower thrips (*Megalurothrips distalis* Karny, *Megalurothrips usitatus* Bagnall and *Caliothrips indicus)* are associated mostly with the damage of tender buds and flowers of mungbean. Severe damage of thrips resulted flower shedding causing significant yield loss (Hossain *et al.,* 2020). Pod borers (*Marucavirtata, Helicoverpa armigera* and *Euchrysops* spp) are another insect pests causing significant yield reduction. Pod borer damaged flowers, flower buds and developing or maturing pods. Pod borers are often cause serious problem resulting severe loss of the crop (Hossain, 2015b). Farmers usually do not take any measure to control the

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insect pests due to its low profit margin. However, recent development of high yielding varieties and increased market prices of mungbean, farmers demanded for pest control measures.

Normally, mungbean growers are using toxic insecticides to control insect pests without looking other management options because of easy availability and effectiveness of insecticides. As insecticide is not environment safe, cause health hazard, create pest resistance and destroys of natural enemies (Jakhar*et al.,* 2018). Therefore, it is urgent to find out the alternate management options for controlling the major insect pests of mungbean which will be environmentally safe and sustainable. Keeping this in view, the present research was undertaken to investigate the useful IPM package using blue sticky trap, bio and synthetic insecticides.

MATERIALS & METHODS

The experiment was conducted at Pulses Research Centre, Bangladesh Agricultural Research Institute (BARI), Ishurdi, Pabna, Bangladesh during kharif-I of 2020, 2021 & 2022. Installing blue sticky trap and application of bio & synthetic insecticides, considered as treatments of the experiment, which were: IPM Package-1: blue sticky trap + two spraying of Biotrine (Matrine 0.5% AS) @ 1.4 ml/l, first spray at 100% flowering stage and second spray after 7 days interval at peak flowering and 100% podding stage + third spraying with spinosad (Success 2.5 EC) @ 1.2 ml/l after 7 days of second spray at seed developing stage, IPM Package-2: blue sticky trap + two spraying of Bio-chamak (*Celastrus angulatus* 1% EW) @ 2.5 ml/l, first spray at 100% flowering stage and second spray after 7 days interval at peak flowering and podding stage + third spraying with spinosad (Success 2.5 EC) @ 1.2 ml/l at seed developing stage (7 days after second spray), IPM package-3: blue sticky trap + two spraying of chlorfenapyr (Intrepid 10 EC) @ 1 ml/l, first spray at 100% flowering stage and second spray after 7 days at peak flowering and podding stage + third spraying with Emamectin Benzoate (Proclaim 5 g) @ 1 g/l at seed developing stage (7 days after second spray), Farmers practice: three spraying of imidachloprid (Imitaf 20 SL) @ 0.5 ml/l of water at 100% flowering, 100% podding and seed developing stage of the crop and untreated control.

The experiment was laid out in randomized complete block design with three dispersed replications. The treatments were randomly allotted in each block. The seeds of BARI Mung-6 were sown in rows with the spacing of 30 cm. The unit plot size was 6m x 4m. Urea, triple super phosphate, muriate of potash and boric acid were applied in the plots @ 40-90-40-7.5 kg/ha during final land preparation. Post sowing flood irrigation was done to provide sufficient soil moisture for seed germination to get optimum plant population in all the treatments. The populations of the plant were maintained constant by keeping plant to plant distance of 7 cm.

Blue sticky traps were installed (one trap/plot) at flower bud initiation stage and kept in the field up to harvest. Treatment-wise bio & synthetic insecticides were sprayed first at 100% flowering stage and second and third sprays were done after 7 days interval at 100 % podding stage and seed developing stage, respectively.

The flower infestation and flower thrips population data were collected before and after 24 hrs of each spray application. Thrips population was assessed from 20 opened flower randomly collected from four rows of each side of the plot avoiding border and central ten rows. The collected flowers were immediately opened on the white paper board and counted the adult and immature thrips present in the flowers. Central ten rows were kept undisturbed for recording yield data.
At maturity, all the pods were collected from 10 randomly selected plants from central four rows of each plot and examined. The infested (bored) and total numbers of pods were counted and the percent pod infestation was determined using the following formula:

$$\%\ \text{Pod infestation} = \frac{\text{Number of infested pods}}{\text{Total number of pods}} \text{X } 100$$

The pods of central ten rows of each plot were harvested. The pods were then threshed; grains were cleaned and dried in the bright sunshine. The grain yield was obtained from central four rows of each plot was converted into per hectare. The experimental data were analyzed by Statistix 10 software. The percent infestation data were transformed to square root for statistical analysis. Mean comparisons for treatment parameters were compared using LSD All- Pair wise Comparisons Test at 5% level of significance.

The marginal benefit cost ratio (MBCR) was calculated on the basis of prevailing market prices of mungbean and cost of blue sticky trap and insecticidal spraying. Marginal benefit cost ratio was calculated as follows:

$$\text{Marginal BCR (over control)} = \frac{\text{Marginal benefit over control}}{\text{Marginal cost over control}}$$

RESULTS AND DISCUSSION

Effect of IPM packages and farmers practice on flower infestation

The effect of integrated management approaches comprising installation of blue sticky traps and application of bio & synthetic insecticides on flower infestation of mungbean are presented in Table 1. Application of IPM approaches and farmers practices are significantly reduced the flower infestation as compared with untreated ones.

During kharif-I 2020, after 24 hrs of spraying, significantly the lowest flower infestation (6.67%) was observed in IPM package-3 which was at par with IPM package-1 and farmers practice. Significantly the highest percentage of flower infestation (53.33%) was found in untreated control plots (Table 1). The reduction percentage of flower infestation was over untreated control ranged from 43.34 to 68.33% (Table 1). The highest percentage of flower infestation reduction (68.33%) was observed in IPM package-3 followed by farmers practice, IPM package-1 and IPM package-2 (Table 1). Again, in both kharif-I 2021& 2022 cropping seasons, a similar phenomenon was observed in the IPM packages and farmers practice for controlling the reduction percentage of flower infestation.

Table 1. Effect of different IPM packages and farmers practice on flower infestation of mugbean during Kharif-I 2020, 2021& 2022

Treatments	Percent flower infestation by thrips						%reduction of flower infestation over unsprayed		
	Before spraying			After 24 hrs. of spraying					
	2020	2021	2022	2020	2021	2022	2020	2021	2022
IPM package-1	60.00	57.50	80.00	8.33	25.00	27.22	51.67	41.67	65.74
IPM package-2	66.67	50.00	83.33	23.33	16.67	29.44	43.34	50.00	62.94
IPM package-3	75.00	46.67	72.22	6.67	15.83	23.33	68.33	50.84	70.63
Farmerspractice	71.67	62.50	76.11	11.67	19.17	24.44	60.00	47.50	69.23
Untreated control	68.33	66.67	79.44	53.33	53.33	62.22	-	-	-

Effect of IPM packages and farmers practice on thrips population in flowers

Thrips population varied significantly depending on the efficacy of the treatments (Table 2). During kharif-I 2020, after 24 hrs of spraying, the lowest thrips population (1.33/20 open flowers) and accordingly the highest percentage of population reduction (91.68%) was found in IPM package-3 which was as same as IPM package-1 and farmers practice followed by IPM package-2 (Table 2). The highest thrips population (16/20 flowers) was found in untreated control plots. Application of IPM packages and farmers practice reduced 66.69 to 91.68% thrips population in flowers (Table 2). Again, in both kharif-I 2021 & 2022 cropping seasons, a similar phenomenon was observed for the reduction percentage of thrips population in flowers due to IPM packages and farmers practices.

These findings of flower infestation and thrips population suppression in mungbean flowers were agreed with the findings of Rahman (2019) who reported the best effect of IPM package consisting installation of blue sticky trap and two spraying of chlorfenapyr (Intrepid 10 EC) at flowering stage. Bhede *et al.* (2008) who reported the best effect of Imidachloprid for control of chillithrips. Hossain *et al.* (2011), Hossain (2014) and Hossain *et al.* (2015a) also found the excellent results of Imidachloprid to reduce flower infestation and suppression of thrips population in mungbean flowers. Cermeli *et. al*. (2002) observed the high efficacy of imidachloprid (86% reduction over control) in controlling thrips infestation in field bean.

Table 2. Effect of different IPM packages and farmers practice on thrips population in mungbean flowers during Kharif-I 2020, 2021 & 2022

Treatments	No. of thrips/20 open flowers						% reduction of thrips population over unsprayed		
	Before spraying			After 24 hrs. of spraying					
	2020	2021	2022	2020	2021	2022	2020	2021	2022
IPM package-1	20.33	16.67	36.22	1.67	6.33	7.78	89.56	65.16	61.31
IPM package-2	23.33	14.50	40.44	5.33	4.00	7.71	66.69	77.99	61.66
IPM package-3	27.67	14.50	35.00	1.33	3.83	4.67	91.68	78.92	76.78
Farmerspractice	34.33	21.17	36.34	2.33	4.00	6.33	85.44	77.99	68.52
Untreated control	23.33	21.67	34.78	16.00	18.17	20.11	-	-	-

Effect of IPM packages and farmers practice on pod borer infestation

Pod borer infestation also varied significantly depending on the efficacy of the treatments(Table 3). During kharif-I 2020, significantly the lowest pod borer infestation (2.67%) and the highest pod infestation reduction (78.35%) were observed in IPM package-2, which were similar to IPM package-3 followed by IPM package-1 and farmers practice. The highest pod infestation (12.33%) was observed in untreated control plots (Table 3).During in both kharif-I 2021 & 2022 cropping seasons, a similar phenomenon was observed for IPM packages and farmers practice in the reduction percentage of pod borer infestation of mungbean.

The integrated and cumulative effect of IPM components reduced more flower thrips and pod borer infestation in IPM plots as compared with farmers practice. These findings of pod borer management agreed with the findings of Rahman (2019) who reported the excellent effect of IPM package consisting installation of blue sticky trap and two spraying of azadiractin (Bioneem plus 1 EC) and third spraying with spinosad (Success 2.5 EC) at poding stage for controlling pod borers of mungbean.

Table 3. Effect of different IPM packages and farmers practice on the incidence of pod borers in mungbean during Kharif-I 2020, 2021 & 2022

Treatments	Pod infestation by pod borer (%)			%Pod borer infestation over untreated		
	2020	2021	2022	2020	2021	2022
IPM package-1	6.50 (2.51)	8.00 (2.83)	7.17 (2.67)	47.28	28.89	38.08
IPM package-2	2.67 (1.58)	4.50 (2.09)	5.92 (2.43)	78.35	60.00	44.88
IPM package-3	4.50 (2.08)	8.25 (2.87)	7.50 (2.73)	63.50	26.67	35.23
Farmerspractice	8.17 (2.84)	8.33 (2.89)	7.92 (2.81)	33.74	25.96	31.61
Untreated control	12.33 (3.51)	11.25 (3.35)	11.58 (3.37)	-	-	-

Effect of IPM packages and farmers practice on yield

The yield of mungbean varied significantly with the level of thrips and pod borer infestation depending on the efficacy of different management packages (Table 4). During kharif-I 2020, the highest yield (1226 kg/ha) was obtained from IPM package-2 which was statistically similar to farmers practice.

Table 4. Effect of different IPM packages and farmers practice on the yield of mungbean during Kharif-I 2020, 2021 & 2022

Treatments	Yield (kg/ha)			% yield increase over untreated		
	2020	2021	2022	2020	2021	2022
IPM package-1	1155	1840	1662	20.06	1.96	21.58
IPM package-2	1226	2071	1974	27.44	15.89	44.40
IPM package-3	989	1803	1595	2.81	0.90	16.68
Farmerspractice	1162	2032	1948	20.79	13.21	42.50
Untreated control	962	1787	1367	-	-	-

Table 5. Cost and return analysis of IPM package and farmers practice for the management of flower thrips and pod borer of mungbean during Kharif-I 2020, 2021 & 2022

Treatments	Yield (kg/ha)			Additional yield over control (kg/ha)			Additional return over control (Tk/ha)			Cost of insecticide appl. (Tk/ha)			Marginal benefit cost ratio		
	2020	2021	2022	2020	2021	2022	2020	2021	2022	2020	2021	2022	2020	2021	2022
IPM package-1	1155	1840	1662	193	53	295	13510	3710	20650	11640	11640	11640	1.16	0.31	1.77
IPM package-2	1226	2071	1974	264	284	607	18480	19880	42490	16060	16060	16060	1.15	1.24	2.65
IPM package-3	989	1803	1595	27	16	228	1890	1120	15960	11150	11150	11150	0.17	0.10	1.43
Farmers practice	1162	2032	1948	200	245	581	14000	17150	40670	4125	4125	4125	3.39	4.16	9.86
Untreated control	962	1787	1367	-	-	-	-	-	-	-	-	-	-	-	-

For calculating income and benefit the following market prices were used: Mungbean = Tk. 70/kg, Blue sticky trap = Tk 50/trap (@80/ha), Biotrin = Tk. 220/100 ml, Bio-Chamak = Tk. 300/100 ml, Success 2.5 EC = Tk. 90/25 ml, Intrepid 10 EC = Tk. 250/100 ml, Proclaim 5 SG = Tk. 45/10 g, Imitaf 20 SL = Tk. 230/100 ml. Labour wage for spraying insecticides = Tk. 400/day/labourer (8 hrs day).

The lowest yield (962 kg/ha) was recorded from untreated control plots which was similar with IPM package-3 (Table 4). In all the three years study, IPM package-3 provided the lower yield as compared to other treatments. Spraying of more toxic Intrepid and Proclaim might influenced to dropping of flowers and immature pods of mungbean with less pod setting resulted lower yield.

The yield was increased over untreated control ranged from 2.81 to 27.44% (Table 4). The highest yield was increased (27.44%) in IPM package-2 and the lowest was in IPM package-3 (Table 4).In both kharif-I 2021& 2022 cropping season,the same trend of yield and yield increasing were found in the treatments.

Return and marginal benefit cost ratio (MBCR)

Return and benefit cost ratio are presented in Table 5. During kharif-I 2020, the highest yield and the highest additional return (18480 Tk/ha) were calculated from IPM package-2 followed by farmers practice and IPM package-1 (Table 5). But the highest benefit (MBCR 3.39) came from farmerspractice (Table 5). The same trend of return and benefit came from kharif-I 2021 & 2022 cropping seasons. This might be due to higher cost of IPM components brought down the profit margin and showed the lower MBCR of IPM packages than that of farmer’s practice.

CONCLUSIONS

Although IPM packages under this study are not financially profitable as farmers practice but considering environment friendliness, the IPM package-2: blue sticky trap + two spraying of Bio-Chamak (*Celastrus angulatus* 1% EW) @ 2.5 ml/l at 100% flowering and 100% podding stage + third spraying with spinosad (Success 2.5 EC @ 1.2 ml/l at seed developing stage would be the best package for controlling flower thrips and pod borers of mungbean with higher yield in the insects prone cropping areas.

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