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NTS ON THE INCIDENCE AND DAMAGE OF FLEA BEETLE (*PHYLLOTRETA NIGRIPES*) AND THRIPS (*MEGALUROTHRIPS USITATUS*) ON MUNGBEAN

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Abstract

An experiment was conducted to evaluate the effectiveness of different treatments for the management of flea beetles and thrips of mungbean using BARI Mung-6 as experimental material. Nine treatments, viz., T_1 = Use of White sticky trap, T_2= Bioneem plus (Azadirachtin) 1%EC @ 1 ml/L of water at 40 DAS, T_3 = Virtako (Chlorantraniliprole + Thiamethoxam) 40 WG @ 0.15g/L of water at 40 DAS, T_4 = Amithrin plus 3% WDG @ 1 ml/L of water at 40 DAS, T_5 = Ecomec (Abamectin) 1.8 EC @ 1 ml/L of water at 40 DAS, T_6 = Nitro (Chlorpyriphos + Cypermethrin) 505 EC @ 1 ml/l of water at 40 DAS, T_7 = Raise (Chlorantraniliprole) 20 SL @ 3 ml/L of water at 40 DAS and T_8 = control were applied. Data were recorded on the number of flea beetles per plant, leaf area damaged by flea beetles, number of thrips-infested flowers per plant, and number of thrips per 20 opened flowers. Results revealed that the lowest number of flea beetles (3.00/m^2 plants) and the highest percent reduction (64.71%) of flea beetle population over control were recorded in Virtako 80 WG at 0.15 g/L of water-treated plots. The lowest percent damage (3.75%) of leaf area and the highest percent reduction (79.73%) of leaf area damage over control were observed in Virtako-treated plots. The lowest number of thrips population (1.50/20 flowers), the highest percent of thrips population reduction (85.37%) over control, the lowest number of infested flowers (0.88/20 flowers) by thrips, and the highest percent reduction (88.65%) of flower infestation over control were found in mungbean plants treated with Raise 20 SL @ 3 ml/L of water. A strong negative correlation between the number of flea beetles and total yield was observed. There were negative relationships between the number of thrips, percent flower infestation, and total yield. Therefore, the application of Virtako 80 WG at 0.15 g/L and Raise (Chlorantraniliprole) 20 SL at 3 ml/L were found to be the best treatments for controlling flea beetles and thrips on mungbean.

Keywords: Insecticide, Pulse, Control, Yield.

Introduction

Mungbean (*Vigna radiata* L.) is also known as "Greengram," which belongs to the family Leguminosae. India, China, Philippines, Burma, Bangladesh, and Pakistan are the major

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mungbean-growing countries in the world. In Bangladesh, mungbeans occupy an area of 46,117.06 hectares and produce 41,548.48 tons (BBS, 2023). Despite having a very low yield (900.93 kg/ha) per unit area, it is recognized as a quality pulse in the country compared to many other countries around the globe (BBS, 2023). It also plays a significant role in supplementing protein for the Bangladeshi people who consume cereal-based low protein.

Mungbean is infested by whiteflies (*Bemisia tabaci*), thrips (*Megalurothrips usitatus*), jassids (*Amrasca biguttula*), stem fly (*Ophiomyia* sp.), epilachna beetle (*Epilachna dodecastigma*), galerucid beetle (*Madurasia obscurella* Jacoby), blister beetle (*Mylabris pustulata* Thunberg), pod sucking bug (*Riptortus dentipes*), tobacco caterpillar (*Spodoptera litura*), and spotted pod borer (*Maruca vitrata*) throughout the year and have significant effects on yield (Kooner *et al.,* 2006; Lal, 1985). The incidence of insect pests considerably reduces the yield and quality of mungbean (Malik, 1994; Elias *et al.,* 1986). The prevailing weather conditions, such as temperature, relative humidity, and precipitation, affect the incidence and development of all insect pests (Aheer *et al.,* 1994; Yadav and Singh, 2013; Yadav *et al.,* 2015).

Among different insect pests, flea beetles and thrips are the most damaging insects of mungbean. Flea beetles (*Phyllotreta nigripes*) attack cotyledons and leaves of seedlings and young plants and feed on them by making innumerable round holes. The percentage of leaf area damaged by flea beetle on BARI Mung-6 is 11.33% (Islam *et al.,* 2021). Older infested leaves dry up, hampering the plant's growth having reduced number of pods (Hossain, 2015). On the other hand, thrips (*Megalurothrips distalis* Karny, *Megalurothrips usitatus* Bangall, and *Caliothrips indicus* Bangall) cause damage mainly on young buds and flowers of mungbean (Lal, 1985). Extensive flower damage of mungbean by thrips resulted in flower shedding, causing significant yield loss (Lal 1985; Chhabra and Kooner, 1985). *Megalurothrips usitatus* causes mung bean production losses ranging from 13% to 64% (Farajallah, 2013).

Several investigators (Litsinger *et al.*, 1988; Singh and Singh, 1977; Hossain, 2015; Alam *et al.,* 2021) studied insect control by chemical insecticides against mungbean pests. Ahmad *et al.* (1998) found that the application of dimethoate (0.03%) or monocrotophos (0.04%) at 45 and 60 days after sowing effectively reduced the insect pest complex of mungbean. Amongst management practices, Admire 200SL (Imidacloprid) @ 0.25 ml/L of water was more effective for the management of whiteflies and thrips in mungbean, followed by Voliam Flexi (Thiamethoxam + Chlorantraniliprole) @ 0.25 ml/L of water

(Alam *et al.,* 2021). Considering the above facts, the experiment was carried out to determine the most effective treatment against flea beetles and thrips on mungbean.

Material and Methods

An experiment was carried out in the farmers' field at Sonakhali village, Barguna Sadar, Barguna district of Bangladesh, from January to April 2017. The experiment was laid out in a randomized, complete design with 3 replications. The entire field was divided into 3 blocks representing replications, and each block was divided into 9 plots. This experiment used 27 plots, and the individual plot size was 3.0 m × 2.0 m. The spacing between plots was 0.75 m, and between blocks was 1 m. Treatments were randomly assigned to each plot within a block. Variety BARI Mung-6 was utilized in this experiment. Seeds were sown continuously in the line at a depth of 4-5 cm on the 1st of February, 2017, at the rate of 20 kg/ha, and covered by loose soil with the help of hand. The row-to-row distance was 15 cm, and the plant-to-plant was 10 cm. Nine treatments viz., T_1 = Use of White sticky trap, T_2= Bioneem plus (Azadirachtin) 1% EC @ 1ml/L of water at 40 DAS, T_3 = Virtako (Chlorantraniliprole + Thiamethoxam) 40 WG @ 0.15g/L of water at 40 DAS, T_4 = Amithrin plus 3% WDG @ 1 ml/l of water at 40 DAS, T_5 = Ecomec (Abamectin) 1.8 EC @ 1 ml/L of water at 40 DAS, T_6 = Nitro (Chlorpyriphos + Cypermethrin) 505 EC @ 1 ml/L of water at 40 DAS, T_7 = Raise (Chlorantraniliprole) 20 SL @ 3 ml/L of water at 40 DAS and T_8 = control were applied. Insecticides were purchased from the Biotech division of Ispahani Agro Limited and the local market. Spray solutions were prepared in the Knapsack sprayer by mixing insecticides with water as recommended, with a pre-fixed concentration of the respective treatments, as required, just before spraying. The spray solution prepared in such a way was sprayed in the assigned plot designed for each treatment. Spraying was done in the afternoon to avoid bright sunlight and to escape pollinators. The precaution was taken to prevent the drift of spray solution to adjacent plots at the time of spray. All sorts of intercultural activities were performed as and when required to ensure the growth and development of the plant.

Data were collected and recorded at ten-day intervals and different growth stages by direct counting early in the afternoon (4.0 - 6.0 pm). Meter square (1 m × 1 m) plants were selected randomly from each plot. The number of flea beetle data was counted by visual eye from each plot's infested and healthy leaves/plants per square meter plants. The flea beetle population was once recorded at the vegetative stage (36 DAS). The leaf area of 5 representative leaves from 5 randomly selected plants of each unit plot was recorded on a leaf area meter (Model LI-3100C), and the mean leaf area was computed.

The percentage of damaged leaves area/plants by flea beetles was determined by eye estimation.

Data on thrips were collected once (at 100% flowering stage) from the flowering stage of mungbean. For assessing the thrips population, twenty opened flowers were randomly collected from two rows on each side of the plot, avoiding border rows and the selected 1 m^2 area of the center of each unit plot. The collected flowers were opened immediately on the white paper and counted thrips. The area of one square meter in the center of each unit plot was kept undisturbed for recording yield data.

Data on total flowers and number of damaged flowers were recorded from 10 randomly selected infested inflorescences of each plot. Then, the percentage of flower infestation by thrips was calculated using the following formula:

$$\% \text{ Flower infestation} = \frac{\text{Total number of infested flowers}}{\text{Total number of flowers}}$$

Statistical Analysis: Data were analyzed using WASP 1.0 (Web-based Agricultural Statistical Package) software following RCB design. Graphical presentation and correlation studies were performed through the Excel program.

Results and Discussion

Effectiveness of different treatments on the population of flea beetles: The effects of different treatments on the incidence of flea beetles and their damage are presented in Table 1. The flea beetle population varied significantly, ranging from 3.0 to 8.50. The square meter of plants with the lowest mean number of flea beetles (3.00/plot) was observed in Virtako 40 WG treated plots followed by Nitro 505 EC (3.75/plot), Raise 20 SL (4.25/plot), Ecomec (5.0/plot), White sticky trap (5.25/plot), Bioneem plus (5.75/plot) and Amithrin plus 3% WDG (6.0/plot). The average flea beetle was recorded maximum in control plots (8.50/plot), which differed statistically from the remaining treatments. The highest percent reduction (64.71%) of flea beetle population was found in Virtako 40 WG treated plots over control, followed by Nitro 505 EC (55.88%) and Raise 20 SL (50.0%), Ecomec (41.18%). The lowest percentage was found in Amithrin plus 3% WDG (29.41%), followed by Bioneem plus (32.25%) and White sticky trap (38.25%).

Again, the damaged leaf area by flea beetles varied significantly, ranging from 3.75 to 18.50%. The lowest percent damaged leaf area (3.75%) was observed in Virtako 40 WG treated plots, followed by Nitro 505 EC (6.0%), Raise 20 SL (7.25%), Amithrin plus 3% WDG (9.50%), Ecomec (10.75%), Bioneem plus (11.50%) and White sticky trap (13.0). The significantly highest mean leaf area damage was recorded in control plots (18.50%), statistically different from other treatments. The highest percent reduction (79.73%) of damaged leaf area was found in Virtako 40 WG treated plots over control, followed by Nitro 505 EC (67.57%), Raise 20 SL (60.81%), Amithrin plus 3% WDG (48.65%). Bioneem plus (41.91%), Ecomec (37.83%). The lowest leaf area damage reduction was found in the White sticky trap (29.72%).

Table 1. Effectiveness of treatments on the incidence of flea beetle on mungbean

Treatments	Mean number of flea beetle/plot	Reduction of flea beetle over control (%)	Leaf area damaged by flea beetle (%)	Reduction of leaf area damaged over control (%)
White sticky trap	5.25 cd	38.25	13.00 c	29.72
Bioneem plus 1% EC @ 1 ml/L of water	5.75 bc	32.35	10.75 d	41.91
Virtako 40 WG @ 0.15 g/L of water	3.00 h	64.71	3.75 h	79.73
Amithrin plus 3% WDG @ 1 ml/L of water	6.00 b	29.41	9.50 bc	48.65
Ecomec @1 ml/L of water	5.00 de	41.18	11.50 cd	37.83
Nitro 505 EC @ 1 ml/ L of water	3.75 g	55.88	6.00 g	67.57
Raise 20 SL @ 3 ml/L of water	4.25 fg	38.24	7.25 ef	60.81
Untreated control	8.50 a	-	18.50 a	-
Level of significance	**	-	**	-
CV (%)	8.43	-	14.81	-

**Significant at 1% level

Means that a column followed by the same letter does not differ significantly from one another by CD values. Values are an average of 3 replications.

Effectiveness of different treatments on the incidence of thrips population and flower infestation: The effect of different treatments on the flower infestation and thrips population reduction over control are presented in Table 2. The significantly lowest

average number of thrips damaged flowers (0.88/20 flowers) was found in Raise 20 SL treated plots followed by Virtako 40 WG (1.25/20 flower), White sticky trap (1.75/20 flowers), Nitro 505 EC (1.75/20 flowers), Bioneem plus (2.25/20 flower), Ecomec (2.50/20 flowers) and Amithrin plus 3% WDG (3.25/20 flowers). The highest mean number of thrips-infested flowers was observed in untreated control plots (7.75/20 flowers), which differed statistically from other treated plots. Likewise, the highest percent reduction (88.65%) of flower infestation was recorded in Raise 20 SL applied plots over control which was followed by Virtako 40 WG (83.86%), White sticky trap (77.42%), Nitro 505 EC (77.42%), Bioneem plus (70.97), Ecomec (76.74%) and Amithrin plus 3% WDG (58.06%). These findings are supported by Bhede *et al.* (2008), who found that Imidacloprid was the best for controlling chili thrips. Hossain *et al.* (2013) showed the best performance of Regent 50 SC (Fipronil) for managing onion thrips with maximum benefit. Imitaf 20 SL (Imidacloprid) was also found effective in reducing thrips population and flower infestation of mungbean (Hossain, 2014)

Table 2. Effectiveness of different treatments on the number of thrips population and flower infestation of mungbean.

Treatments	No. of infested flower by thrips /plant	Percent reduction of infested flowers over control	Mean no. thrips/20 opened flower	Percent reduction of thrips over control
White sticky trap	1.75 de	77.42	2.00 bcd	80.48
Bioneem plus 1% EC @ 1 ml/L of water	2.25 cd	70.97	7.25 bcd	78.05
Virtako 40 WG @ 0.15 g/L of water	1.25 ef	83.87	1.75cd	82.93
Amithrin plus 3% WDG @ 1 ml/L of water	3.25 b	58.06	3.00bc	70.73
Ecomec1ml/liter of water	2.50 c	67.74	6.50bcd	75.61
Nitro 505 EC @ 1 ml/L of water	1.75 de	77.42	1.75cd	82.93
Raise 20 SL@ 3 ml/L of water	0.88 f	88.65	1.50d	85.37
Untreated control	7.75 a	-	10.25a	-
Level of significance	**	-	**	-
CV (%)	17.21	-	18.45	-

**Significant at 1% level. Means that a column followed by the same letter does not differ significantly by CD values. Values are the mean of 3 replications.

In case of thrips population, the lowest mean number of thrips population (1.50/20 flowers) was observed in Raise 20 SL treated plots followed by Virtako 40 WG (1.75/20 flowers), Nitro 505 EC (1.75/20 flowers), White sticky trap (2.0/20 flowers), Bioneem plus (2.25/20 flowers), Ecomec (2.50/20 flowers) and Amithrin plus 3% WDG (3.00/20 flowers). The maximum mean number of thrips population was found in control plots (7.75/20 flowers), which differed statistically from other treatments. The highest percent reduction of thrips population (85.37%) was found in Raise 20 SL treated plots over control followed by Virtako 40 WG (82.93%), Nitro 505 EC (82.93%), White sticky trap (80.48%), Bioneem plus (78.05). The lowest percent reduction was found in Amithrin plus 3% WDG (70.71%), followed by Ecomec (75.61%).

Relationship between flea beetle population and yield: Yield is influenced by the incidence of flea beetle per square meter plant. A strong negative correlation between the number of flea beetles and yield was observed, indicating a progressive decline in the yield with the increasing flea beetle population. A linear regression was fitted between flea beetle abundance and yield (Fig. 1). The correlation coefficient (r) was 0.79, and the contribution of the regression (R^2 = 0.6302, when Y = -24.861x + 674.23) was 63.02%.

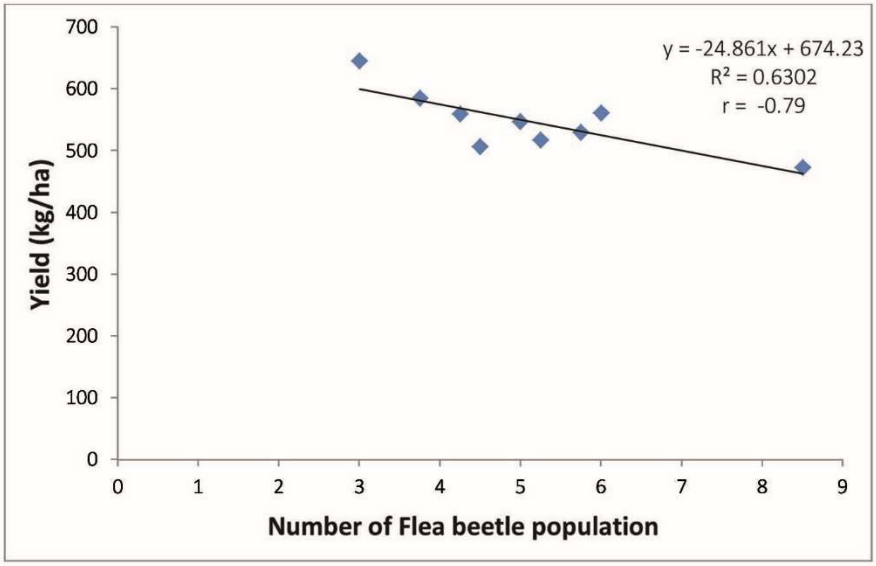

Fig. 1. Relationship between flea beetle incidence and yield of mungbean obtained from different treatments.

Relationship between thrips population and yield: Yield was moderately influenced by the incidence of thrips per square meter area of plant. There was a negative correlation between number of thrips and yield. It was evident that there was a gradual decrease in the yield with the increase of thrips. A linear regression was fitted between thrips abundance and yield (Fig. 2). The correlation coefficient (r) was 0.64, and the contribution of the regression (R^2 = 0.4142, when Y= -11.686x + 583.85) was 41.24%.

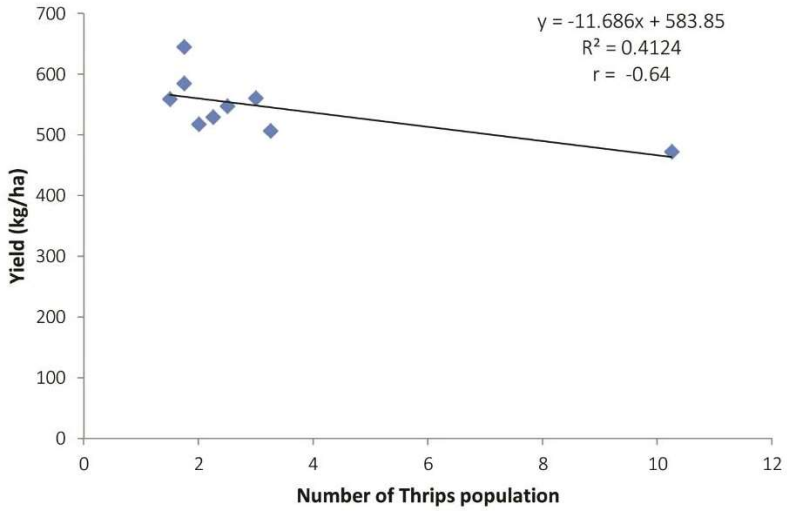

Fig. 2. Relationship between thrips incidence and yield of mungbean obtained from different treatments.

Relationship between flower infestation and yield: A negative relationship between percent flower infestation and yield was found in different treatments, revealing that the yield gradually decreased with increasing flower infestation by thrips. A linear regression existed between thrips infestation and yield (Fig. 3). The correlation coefficient (r) was 0.66, and the contribution of the regression (R^2 = 0.4371, when Y = - 16.108x + 590.35) was 43.71%.

The results of the present study are supported by Ullah *et al.* (2022), who found that the application of Virtako 80WG @ 0.15 g/L water + white sticky trap was the best package for managing flea beetle and thrips in mungbean. Alam *et al.* (2021) also found that the application of Admire 200SL @ 0.25 ml/l of water and Voliam Flexi (Thiamethoxam+ Chlorantraniliprole) @ 0.25 ml/L of water at 10-day intervals were more effective for suppressing whitefly and thrips in mungbean. Yasmin *et al.* (2019) found that Stargate.

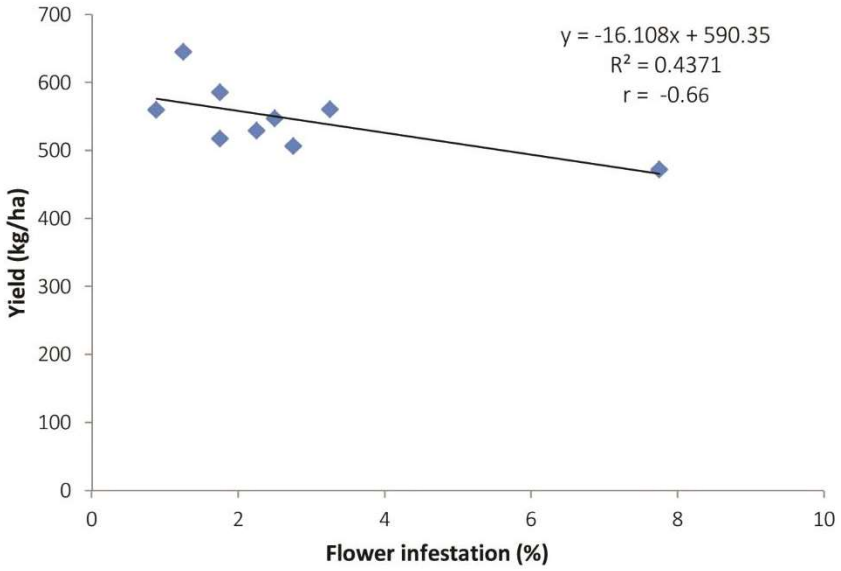

Fig. 3. Relationship between thrips infestation and yield of mungbean obtained from different treatments.

48SC (clothianidin) was the most effective insecticide against the thrips species Megalurothripsusitatus and Thrips palmi, with the highest reduction of the population on top trifoliate leaves and terminal shoots (100.00 and 89.40%, respectively) at vegetative stage and reduction on flower buds and flowers (86.04 and 85.95%, respectively) at reproductive stage of mung bean. Sachan (1986) has reported widespread thrips damage to mungbean flowers. They stated that flowers, petioles, and stigmas were eaten by thrips, which resulted in deformed inflorescences and immature flowers dropped. Spraying of Fenitrothion 0.1% at the flowering stage and a second spray either at an interval of 15 days or at the pod-forming stage provided the highest cost-benefit ratio (Rahman, 1989).

Conclusion

The treatment compositions Virtako (Chlorantraniliprole + Thiamethoxam) 80 WG @ 0.15 g/L of water and Raise (Chlorantraniliprole) 20 SL @ 3 ml/L of water were found effective for the management of flea beetles and thrips, respectively. Hence, these two insecticides could be suggested for their management.

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