EFFICACY OF BIO-RATIONAL INSECTICIDES IN CONTROLLING THRIPS IN SUMMER COUNTRY BEAN

ABSTRACT

Aims: To study the efficacy of biorational insecticides in controlling thrips in summer country bean.

Study design: The study used a single component Randomized Complete Block Design (RCBD) with three replications.

Place and Duration of Study: The experiment was conducted in the central farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh from March to May 2021.

Methodology: The experiment consisted of seven treatments and was laid in a single factor Randomized Complete Block Design (RCBD) with three replications. The experiment consists of the following management practices: T_1=Spraying Neem oil @6 ml/L of water at 7 days interval, T_2=Spraying Neem leaf extract @200mg/L of water at 7 days interval, T_3= Mehgoni leaf extract@200mg/L of water at 7 days interval, T_4=Tobacco leaf powder@30mg/L of water at 7 days interval, T_5= Spraying Spinosad @0.4ml/L of water at 7 days interval, T_6=Spraying Biotrin@1.4ml/L of water at 7 days interval and T_7= Untreated control.

Results: Among the seven (7) treatments the lowest number of thrips (2.50 plant-1) was observed in T_5 (Spraying Spinosad @0.4ml/L of water at 7 days interval), while highest number of thrips (16.67 plant-1) was observed in T_7 (Untreated control). The highest percentage of thrips reduction over control (85.50%) was observed in T_5 (Spraying Spinosad @0.4ml/L of water at 7 days interval) treatment. The present study revealed that the lowest number of thrips as insect pest and increased plant, leaf, inflorescence and pod infestation, different yield contributing characters and yield of country bean might be obtained by using the treatment T_5 (Spraying Spinosad @0.4ml/L of water at 7 days interval) besides T_6 (Spraying Biotrin@1.4ml/L of water at 7 days interval) performed as second best treatment whereas, T_7 (Control) and T_3 (Mehgoni leaf extract@200mg/L of water at 7 days interval) may protect the country bean at lowest rate in summer.

Conclusion: It can be concluded that, spraying of Spinosad @0.4ml/L of water at 7 days interval as a bio-rational management practice for thrips population control for country bean variety BARI Sheem-4 in summer reduced the infestation of Thrips at the most satisfactory level.

Keywords: Biorational insecticides, Thrips, Country bean, leaf extract

1. INTRODUCTION

Country bean(*Lablab purpureus)* is an important vegetable-cum-pulse, food-secure and nutritious crop and well known as “Sheem”. It is reported to be originated in India [1], then spread to other parts of the world. It is grown in a significant acreage after brinjal and tomato in Bangladesh. In Bangladesh, country bean has been cultivated in 51578 acres of land with a production of 144050 metric ton[2]. Country bean (*Lablab purpureus*) is normally grown during the rabi or winter season. Around 12,000 ha lands are cultivated and 50,000 metric tons of pods are produced every year. Country bean is rich in protein and can be grown easily on roof tops or trellises. Insect pests and diseases have caused a sharp decline in Bangladesh's country bean production, despite the crop's importance [3, 4]. From the time of seedling to harvest, almost 55 different types of mites and insect pests target country beans [5]. Thrips, Aphids, bean bugs, green semiloopers, hooded hoppers, leaf miners, leaf weevils, pod borers, shot borers, shoot weevils, epilachna beetles, and mites are among the insect pests that seriously harm the nation's bean

crop economically [6]. Thrips is one of the most important insect pests of country bean at flowering and harvesting stage [7]. Thrips damages the pods of beans. Infestation begins in the flowers and pods become twisted, deformed with reddish-brown russet marks as the thrips feed. Large infestation causes poor pod set, stunted plants and leaves and flowers to wilt [7]. Farmers in Bangladesh mostly use chemical pesticides due to their affordability, availability, and efficacy [8, 9]. The ecology and the biodiversity of the land is severely harmed due to indiscriminate use of pesticide without consideration of their negative consequences [10].

In most of the cases, the farmers either forgot the instructions or did not care to follow those instructions and went on using insecticides at their own choice or experience. Some farmers believed that excess use of insecticide could solve the insect pests' problem. As a result, harmful impact of insecticides on man, animal, wildlife, beneficial insectsand environment is imposing a serious threat. Previously many researchers have also used and evaluated different synthetic chemicals against different insect pests, especially against sucking insects like thrips of country bean. These conventional chemical control measures failed to adequately control thrips which results in severe yield losses [11].

Products derived from the natural sources are known as bio-rational insecticide such as plant extracts, insect pathogens etc. are efficacious against target pest but safe to major natural enemies. As a result, bio-rational insecticides are becoming popular day-by-day considering the above situations present experiment was conducted to find a suitable way to safe production of country bean with profitable yield. For controlling the insect pest successfully and to save biological control agents, it is necessary to use environmentally safe insecticides judiciously. In this experiment, an effort was taken to find out the most effective bio-insecticide in controlling thrips of country bean, under the circumstances of the necessity to find out some eco-friendly alternative methods for thrips management.

2. MATERIALS AND METHODS

The present research was conducted at the research field of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka during the period from Marchto May 2021. Summer-country bean variety BARI Sheem-4 was used as experimental materials for the study and the seed of the variety of this experiment collected from Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur. The experiment comprised of seven treatments including an untreated control applied at 7 days interval. The details of the treatments are given below: T_1=Spraying Neem oil @ 3 ml/L of water, T_2=Spraying Neem leaf extract @200mg/L of water, T_3= Mehgoni leaf extract@200mg/L of water, T_4=Tobacco leaf powder@30mg/L of water, T_5= Spraying Spinosad @0.4ml/L of water T_6=Spraying Biotrin@1.4ml/L of water T_7=Untreated control.The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications using variety BARI Sheem-4. Each block was divided into seven equal plots. Thus, there were 21 (3 × 7) unit plots altogether in the experiment. The size of each unit plot was 3 m × 2 m. The distance between block to block and that of the plot to plot was 1.0 m and 1.0 m, respectively. The treatments of the experiment randomly allotted into the experimental plot.The fertilizers were applied as per fertilizers recommendation guide [12]. The applied manures were mixed properly with the soil in the plot using a spade. The dose and method of application of fertilizers are as Urea 30 kg/ha. TSP 70 kg/ha. And MP 35 kg/ha.Seeds were sown on 6thMarch 2021 at the rate of 45 kg ha^{-1} in the furrow and the furrows were covered with soils soon after seeding. The line to line (furrow to furrow) distance was maintained treatment arrangements with continuous sowing of seeds in the line. Plant to plant distance was 6 cm.Data were collected on different parameters viz**.** number of thrips incidence plant^{-1}, number of infested plant plot^{-1}, number of infested leaf plant^{-1}, number of infested inflorescence plant^{-1}, number of infested pod inflorescence^{-1}. The data obtained from experiment on various parameters were statistically analyzed in MSTAT-C computer program [13]. The mean values for all the parameters were calculated and the analysis of variance for the characters was accomplished by the Least Significant Differences (LSD) test at 5 % levels of probability [14].

3. RESULTS AND DISCUSSION

3.1. Incidence of thrips in summer country bean under different bio-rational insecticides

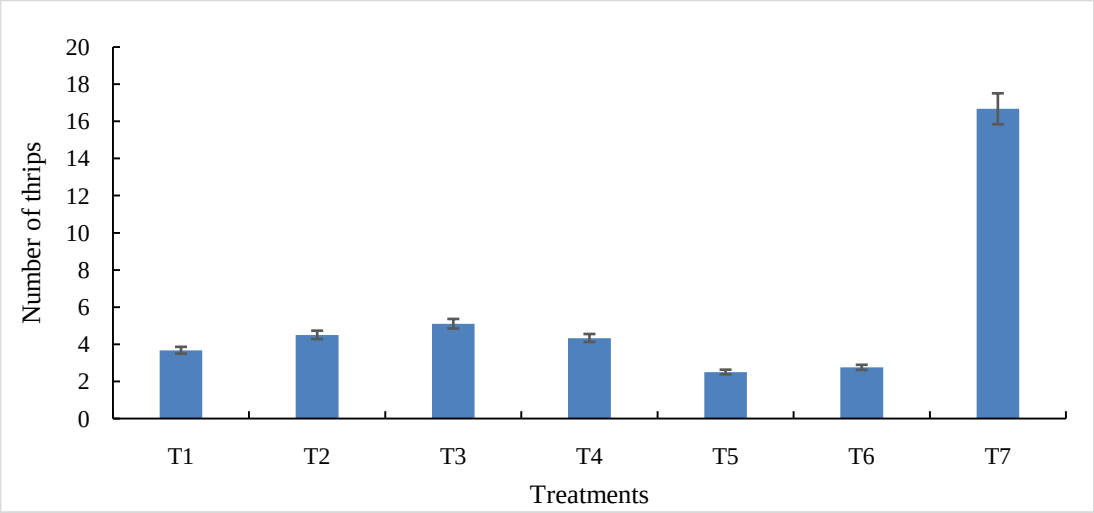

Figure 1. Average population of thrips and efficiency of different bio-rational insecticides country bean in summer

The average population of thrips in summercountry bean under different bio-rational insecticides has been shown in Figure 1. The data (Table 1) expressed that the lowest number of thrips (2.50 plant^{-1}) was observed in T_5 (Spraying Spinosad @0.4ml/L of water at 7 days interval), while highest number of thrips (16.67 plant^{-1}) was observed in T_7 (Untreated control). The highest percentage of thrips reduction over control (85.50%) was observed in T_5 (Spraying Spinosad @0.4ml/L of water at 7 days interval) treatment.

3.2. Number of infested plants plot^{-1}

Plant infestation caused by thrips on summer country bean was significantly varied in different effect of bio-rational insecticides (Table 1). The result demonstrated that the lowest percent plant infestation (33.30%) was found in T_6 (Spraying Biotrin@1.4ml/L of water at 7 days interval), and the highest percent plant infestation (60%) was found in T_7 (Untreated control). The lowest number of infested plants (3.33 plot^{-1}) was observed in T_6 (Spraying Biotrin@1.4ml/L of water at 7 days interval), the highest number of infested plants (6 plot^{-1}) was observed in T_7 (Untreated control). The lowest number of healthy plants (4 plot^{-1}) was observed in T_7 (Untreated control), the highest number of healthy plants (6 plot^{-1}) was observed in T_5 (Spraying Spinosad @0.4ml/L of water at 7 days interval). Similar result was also observed by [15].

Table 1.Efficiency of different bio-rational insecticides against leaf infestation in controlling Thrips of country bean in summer

Treatments	Number observed plants plot^{-1}	Number healthy plants plot^{-1}	Number infested plants plot^{-1}

T_1 (Neem oil @ 3 ml/L of water)	10	5.30 ab	4.67 ab
T_2 (Neem leaf extract @ 200mg/L of water)	10	5.10 ab	4.90 ab
T_3(Mehgoni leaf extract @ 200mg/L of water)	10	4.50 bc	5.50 ab
T_4 (Tobacco leaf powder @ 30mg/L of water)	10	4.70 b	5.30 ab
T_5 (Spinosad @ 0.4ml/L of water)	10	6.00 a	4.00 bc
T_6 (Biotrin @1.4ml/L of water)	10	5.67 ab	3.33 c
T_7 (Untreated control)	10	4.00 c	6.00 a
LSD (0.05)	-	1.29	1.08
Level of Sig.	-	*	**
CV %	-	8.41	11.05

[In a column, means followed by the same letter(s) are not significantly different at 5% level of probability by Least Significant Differences (LSD)]

3.3. Number of infested inflorescence plant^{-1}at different flowering stages

Inflorescence infestation at early flowering stage caused by thrips on summer country bean was significantly varied in different effect of bio-rational insecticides (Table 2). The lowest number of infested inflorescence (5.00 plant^{-1}) was observed in T_5 (Spraying Spinosad@0.4ml/L of water at 7 days interval), the highest number of infested inflorescence (11.75 plant^{-1}) was observed in T_7 (Untreated control). At mid flowering stage, the lowest number of infested inflorescence (8.00 plant^{-1}) was observed in T_5 (Spraying Spinosad@0.4ml/L of water at 7 days interval), the highest number of infested inflorescence (14.33 plant^{-1}) was observed in T_7 (Untreated control). The lowest number of infested inflorescence (4.00 plant^{-1}) was observed in T_5 (Spraying Spinosad@0.4ml/L of water at 7 days interval), the highest number of infested inflorescence (10.75 plant^{-1}) was observed in T_7 (Untreated control). These results support the findings of Atakan [16].

Table 2. Efficiency of different bio-rational insecticides against inflorescence infestation in controlling Thrips of country bean in summer at different flowering stage

Treatments	Number infested inflorescence plant^{-1}	Number infested inflorescence plant^{-1}	Number infested inflorescence plant^{-1}

	Early flowering stage	Mid flowering stage	Late flowering stage
T_1 (Neem oil @ 3 ml/L of water)	6.67 de	9.67 d	5.66 cd
T_2 (Neem leaf extract @ 200mg/L of water)	7.00 d	10.33 cd	6.00 bc
T_3(Mehgoni leaf extract @ 200mg/L of water)	9.33 b	12.10 b	7.33 b
T_4 (Tobacco leaf powder @ 30mg/L of water)	7.73 c	10.80 c	6.50 bc
T_5 (Spinosad @ 0.4ml/L of water)	5.00 ef	8.00 e	4.00 e
T_6 (Biotrin @1.4ml/L of water)	5.67 e	8.50 de	4.67 d
T7 (Untreated control)	11.75 a	14.33 a	10.75 a
LSD (0.05)	1.29	1.17	1.77
Level of Sig.	**	**	*
CV %	8.70	5.04	10.33

[In a column, means followed by the same letter(s) are not significantly different at 5% level of probability by Least Significant Differences (LSD)]

3.4. Number of infested flower inflorescence^{-1} at different flowering stages

Flower infestation at early flowering stage caused by thrips on summer country bean was significantly varied in different effect of bio-rational insecticides (Table 3). The lowest number of infested flower (2.00 inflorescence $^{-1}$) was observed in T_5 (Spraying Spinosad@0.4ml/L of water at 7 days interval), the highest number of infested flower (5 inflorescence $^{-1}$) was observed in T_7 (Untreated control).

At mid flowering stage, the lowest number of infested flower (3.00 inflorescence^{-1}) was observed in T_5 (Spraying Spinosad@0.4ml/L of water at 7 days interval), the highest number of infested flower (5 inflorescence $^{-1}$) was observed in T_7 (Untreated control) (Table 3). The result demonstrated that the lowest percent flower infestation (20%) was found in T_5 (Spraying Spinosad @0.4ml/L of water at 7 days interval), the highest percent flower infestation (47.62%) was found in T_7 (Untreated control) (Table3).

At later stage, the lowest number of infested flower (1.67 inflorescence $^{-1}$) was observed in T_5 (Spraying Spinosad@0.4ml/L of water at 7 days interval), the highest number of infested flower (3.75 inflorescence $^{-1}$) was observed in T_3 (Mehgoni leaf extract@200mg/L of water at 7 days interval) (Table 3). Botanical insecticides are naturally occurring chemicals extracted from plants. They are easily biodegradable, maintain biological diversity of predators and reduce environmental degradation and human health hazards [17]. Studies by Nderitu *et al.*[18]. Palumbo *et al.* [19]. indicated that botanical pesticides are not as effective as synthetic pesticides, however neem based pesticides can be used in an IPM program to neem-based use of synthetic insecticides and production costs.

Table 3. Efficiency of different bio-rational insecticides against flower infestation in controlling Thrips of country bean in summer at different flowering stage

Treatments	Number of infested flower inflorescence^{-1}	Number of infested flower inflorescence^{-1}	Number of infested flower inflorescence $^{-1}$

	Early	Mid	Late
T_1 (Neem oil @ 3 ml/L of water)	3.80 b	4.00 ab	2.67 bc
T_2 (Neem leaf extract @ 200mg/L of water)	4.33 ab	4.33 ab	3.33 ab
T_3(Mehgoni leaf extract @ 200mg/L of water)	4.67 ab	4.75 ab	3.75 a
T_4 (Tobacco leaf powder @ 30mg/L of water)	4.33 ab	4.67 ab	3.33 ab
T_5 (Spinosad @ 0.4ml/L of water)	2.00 c	3.00 bc	1.67 c
T_6 (Biotrin @1.4ml/L of water)	2.67 bc	3.33 b	2.33 bc
T7 (Untreated control)	5.00 a	5.00 a	3.67 ab
LSD (0.05)	1.04	1.05	1.24
Level of Sig.	**	*	**
CV %	6.43	4.61	3.78

[In a column, means followed by the same letter(s) are not significantly different at 5% level of probability by Least Significant Differences (LSD)]

3.5. Number of infested pod inflorescence^{-1} at different fruiting stages

Pod infestation at early flowering stage caused by thrips on summer country bean was significantly varied in different effect of bio-rational insecticides (Table 4). The result demonstrated that the lowest percent pod infestation (23.30%) was found in T_5 (Spraying Spinosad @0.4ml/L of water at 7 days interval), the highest percent pod infestation (62.50%) was found in T_7 (Untreated control). The lowest number of infested pod (2.33 inflorescence $^{-1}$) was observed in T_5 (Spraying Spinosad@0.4ml/L of water at 7 days interval), the highest number of infested pod (5 inflorescence $^{-1}$) was observed in T_7 (Untreated control). The lowest number of healthy pod (4 inflorescence $^{-1}$) was observed in T_7 (Untreated control), the highest number of healthy pod (7.67 inflorescence $^{-1}$) was observed in T_5 (Spraying Spinosad @0.4ml/L

Pod infestation at mid flowering stage caused by thrips on summer country bean was significantly varied in different effect of bio-rational insecticides (Table 4). The result demonstrated that the lowest percent pod infestation (22.56%) was found in T_5 (Spraying Spinosad @0.4ml/L of water at 7 days interval), the highest percent pod infestation (66.62%) was found in T_7 (Untreated control). The lowest number of infested pod (2.33 inflorescence $^{-1}$) was observed in T_5 (Spraying Spinosad@0.4ml/L of water at 7 days interval), the highest number of infested pod (5.33 inflorescence $^{-1}$) was observed in T_7 (Untreated control). The lowest number of healthy pod (3.67 inflorescence $^{-1}$) was observed in T_7 (Untreated control), the highest number of healthy pod (8 inflorescence $^{-1}$) was observed in T_5 (Spraying Spinosad @0.4ml/L of water at 7 days interval).

Pod infestation at late flowering stage caused by thrips on summer country bean was significantly varied in different effect of bio-rational insecticides (Table 4). The result demonstrated that the lowest percent pod infestation (21.05%) was found in T_5 (Spraying Spinosad @0.4ml/L of water at 7 days interval), the highest percent pod infestation (50%) was found in T_7 (Untreated control). The lowest number of infested pod (2 inflorescence $^{-1}$) was observed in T_5 (Spraying Spinosad@0.4ml/L of water at 7 days interval), the highest number of infested pod (3 inflorescence $^{-1}$) was observed in T_7 (Untreated control) and T_3 (Mehgoni leaf extract@200mg/L of water at 7 days interval). The lowest number of healthy pod (2 inflorescence $^{-1}$) was observed in T_7 (Untreated control), the highest number of healthy pod (7.5 inflorescence $^{-1}$) was observed in T_5 (Spraying Spinosad @0.4ml/L of water at 7 days interval).

Table 4. Efficiency of different bio-rational insecticides against pod infestation in controlling Thrips of country bean in summer at different fruiting stages

Treatments	Number of infested pod inflorescence^{-1}	Number of infested pod inflorescence^{-1}	Number of infested pod inflorescence^{-1}
	Early	Mid	Late
T_1(Neem oil @ 3 ml/L of water)	3.00 bc	3.67 ab	2.33 ab
T_2(Neem leaf extract @ 200mg/L of water)	3.67 b	3.80 ab	2.67 ab
T_3(Mehgoni leaf extract @ 200mg/L of water)	4.00 ab	3.33 ab	3.00 a
T_4 (Tobacco leaf powder @ 30mg/L of water)	3.80 ab	3.00 b	2.67 ab
T_5 (Spinosad @ 0.4ml/L of water)	2.33 c	2.33 bc	2.00 bc
T_6 (Biotrin @1.4ml/L of water)	2.67 bc	2.67 bc	2.50 ab
T7 (Untreated control)	5.00 a	5.33 a	3.00 a
LSD (0.05)	1.08	1.05	0.93
Level of Sig.	**	**	*
CV %	3.19	6.33	4.05

In a column, means followed by the same letter(s) are not significantly different at 5% level of probability by Least Significant Differences (LSD)]

3.6. Pod yield (Ton/ha.)

Infestation caused by thrips on summer country bean was significantly varied in different effect of bio-rational insecticides (Figure2). The result demonstrated that the lowest pod yield (7.25 t/ha) was found in T_3 (Mehgoni leaf extract@200mg/L of water at 7 days interval), the highest pod yield (16 t/ha) was found in T_5 (Spraying Spinosad @0.4ml/L of water at 7 days interval). (Figure 2)

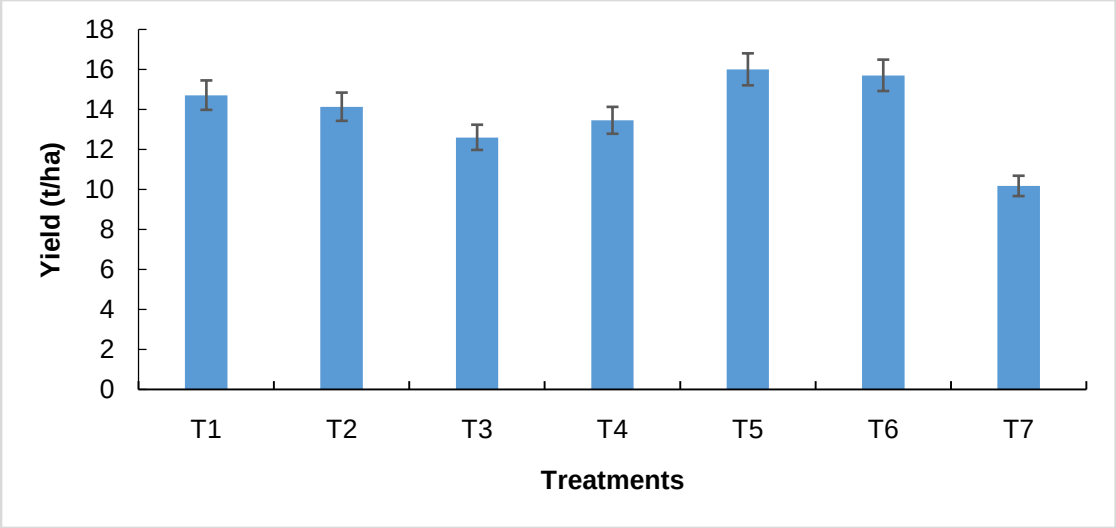

Figure 2. Efficiency of different bio-rational insecticides against yield of country bean in controlling Thrips in summer

4. CONCLUSION

The present study revealed that the lowest number of thrips as insect pest and increased plant, leaf, inflorescence and pod infestation, different yield contributing characters and yield of country bean might be obtained by using the treatment T_5 (Spraying Spinosad @0.4ml/L of water at 7 days interval) besides T_6 (Spraying Biotrin@1.4ml/L of water at 7 days interval)performed as second best treatment whereas, T_7 (Control) and T_3 (Mehgoni leaf extract@200mg/L of water at 7 days interval) may protect the country bean at lowest rate in summer. The highest (3.08) benefit cost ratio was obtained due to application of T_5(Spraying Spinosad @ 0.4ml/L of water at 7 days interval) while the lowest (2.26) in T_7(control). From the above description, it can be concluded that, spraying of Spinosad @0.4ml/L of water at 7 days interval as a bio-rational management practice for thrips population control for country bean variety BARI Sheem-4 in summer reduced the infestation of Thrips at the most satisfactory level.

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