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Effect of Insecticides on Lady Bird Beetle (Coleoptera: Coccinellidae) in Country Bean Field

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Abstract: The study was carried out to evaluate the effect of some insecticides on the abundance and mortality of predacious lady bird beetle in country bean ecosystem. Neemoil (fresh) @ 2.5 ml / L water (22.45/plot), Curtap 50 SP @ 2.0 g / L water (17.97/plot) and Emamectin benzoate 5 SG @ 1.0 g / L water (15.63/plot) ensure highest abundance of lady bird beetle after untreated control (28.78/plot). Highest number of dead lady bird beetle was found in Curtap 50 SP @ 2.0 g / L water (4.45/plot), Esfenvelarate 5 EC @ 1.0 ml / L water (4.29/plot) and Deltrametrin 2.5 EC @ 1.0 ml / L water (3.96/plot) treated plot and that of lowest was in Neemoil (fresh) @ 2.5 ml/L water (2.13/plot), Neemoil (stored) @2.5 ml/L water (2.46/plot) and Fenvelarate 20 EC @ 1 ml / L water (2.70/plot). Neemoil (fresh) @ 2.5 ml / L water (9.37 % mortality), Neemoil (stored) @ 2.5 ml / L water (17.45 % mortality) and Emamectin benzoate 5 SG @ 1.0 g / L water (19.04 % mortality) found least toxic to lady bird beetle as they confirmed least mortality among the tested insecticides. Esfenvelarate 5 EC @ 1.0 ml / L water (33.78 % mortality), Cypermethrin 10 EC @ 1.0 ml / L water (31.76 % mortality) and Deltrametrin 2.5 EC @ 1.0 ml / L water (28.42 % mortality) found highly toxic to lady bird beetle.

Key words: Predator · Ladybird beetle · Percent mortality

INTRODUCTION

Biological control is the action of parasitoids, predators and pathogens in maintaining other organism's density at a lower average than would otherwise occur [1]. The biological control is one of the most effective means of achieving insect control [2]. It includes both naturally occurring control and control achieved as a result of man's augmentation of the natural enemy component. Natural enemies / biological control agents are the most important factors to regulate the pest population for keeping the insect pests below economic injury level in country bean field. Among them lady bird beetle, tiger beetle, Pentatomid bug, spiders, dragon flies, damsel flies, ichneumonids, brachonids, tachinids, chalcids are important biological control agents.

According to Sathe and Bhosale [3], predators are the organisms, which directly attack, kill and eat one of the other species (prey of host). Typically, insect predators are characterized by a set of attributes that distinguish them from parasitoids, the other major group of entomophagous insects. They are large relative to their prey and require more than one prey individual to complete development; they have free-living predatory immature stages; and many species of insect predators are predacious as both immature and adults [4]. The population growth of any pest species is effectively controlled by their natural enemies [5]. The lady beetles are predacious both at larval and adult stages and feed on various crop pests such as aphids and other soft bodied insects like brown plant hopper, thrips etc [6,7]. The female lady bird beetles are more effective in aphid predation in compared to the male beetles [8].

Farmers usually spray insecticides in their field indiscriminately even without thinking the economic return of their investment. As a result, harmful impact of insecticides on man, animal, wild life, beneficial insects and environment is posing a serious threat. It also causes insecticide resistance in insect pests, resurgence and secondary pest outbreak. Moreover, there are some insecticides, which are relatively safer for natural enemies, effective in controlling the pests with minimum hazards to natural enemies. But their information under Bangladesh condition is not exactly known. Therefore, the present study has been proposed to evaluate the detrimental effect of the insecticides on lady bird beetle in country bean field as well as to identify insecticides which are safer to lady bird beetle.

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MATERIALS AND METHODS

The study was conducted at the Research field of Entomology Department in Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh during the period from May to July 2009. The experiment was laid out in randomized complete block design (RCBD) with three replications. The Country bean variety "IPSA Seem 2" was grown following the the recommended practices as described by Zaman [9]. The treatments comprised of seven synthetic insecticides, two botanicals application and one untreated control. The treatments were, T_1 = Cypermethrin 10 EC @ 1.0 ml / L water; T_2 = Fenitrothion 50 EC @ 1.0 ml / L water; T_3 = Fenvelarate 20 EC @ 1.0 ml / L water; T_4 = Emamectin benzoate 5 SG @ 1.0 g / L water; T_5 = Deltrametrin 2.5 EC @ 1.0 ml / L water; T_6 = Esfenvalerate 5 EC @ 1.0 ml / L water; T_7 = Curtap 50 SP @ 2.0 g / L water; T_8 = Neemoil (fresh) @ 2.5 ml / L water; T_9 = Neemoil (stored) @ 2.5 ml / L water; T_{10} = Untreated control.

The synthetic insecticides were collected from the local market of Gazipur, Neemoil (fresh) was collected from the Crashing mill located at Kakonhat bazar, Godagari, Chapai Nawabgonj and the stored Neemoil which was preserved at room temperature for 16 month was collected from laboratory of entomology department, Bangabandhu Sheikh Mujibur Rahman Agricultural University. The insecticides were sprayed at 10 days interval on the whole plant canopy by knapsack sprayer. Measuring cylinder and balance was used to take the appropriate amount of insecticides for spray solution preparation. Precautions were taken to avoid drift to the adjacent plots. For the purpose of counting lady bird beetle, close monitoring of the entire plot was done twice a week through visual search and sweep net and their number per plot was noted. For observing the toxicity of insecticides on lady bird beetle, the number of dead lady bird beetle in the field was recorded from just after spraying to next day and the number of dead lady bird beetle in each plot was counted to calculate percent mortality.

The collected data were properly compiled, coded, tabulated and analyzed statistically using MSTAT-C software. The means were separated for significant difference using the Duncan's Multiple Range Test (DMRT). Different parameters were measured by utilizing various formulae described below:

$$\text{Percent Mortality} = \frac{\text{Number of insect died}}{\text{Total number of insect present}} \times 100$$

$$\text{Mean value of the treatment} = \text{Mean value of the control} - \frac{\text{Percent reduction over control}}{\text{Mean value of the control}} \times 100$$

RESULT AND DISCUSSION

Effect of Insecticides on Abundance of Lady Bird Beetle in Country Bean Field: The insecticides have adverse effect on abundance of lady bird beetle in country bean field (Table 1). The highest number of lady bird beetle was found in untreated control (28.78 / plot) plot which was followed by Neemoil (fresh) @ 2.5 ml / L water (22.45 / plot) and Curtap 50 SP @ 2.0 g / L water (17.97 / plot), Emamectin benzoate 5 SG @ 1 g / L water (15.63/plot), Fenitrothion 50 EC @ 1 ml / L water (15.43/plot) and Neemoil (stored) @ 2.5 ml / L water (14.10/plot). Whereas the lowest number of lady bird beetle was found in Fenvelarate 20 EC @ 1.0 ml / L water (10.67 / plot) treated plot which was followed by Cypermethrin 10 EC @ 1.0 ml / L water (11.43 / plot), Esfenvalerate 5 EC @ 1 ml / L water (12.72/plot) and Deltrametrin 2.5 EC @ 1 ml / L water (13.93/plot). For percent reduction of lady bird beetle over control, highest performance was found in Fenvelarate 20 EC @ 1.0 ml / L water (62.93 %) which was followed by Cypermethrin 10 Ec @ 1.0 ml / L water (60.28 %), Esfenvelarate 5 EC @ 1.0 ml / L water (55.80 %), Deltrametrin 2.5 EC @ 1.0 ml / L water (51.60 %) and Neemoil (stored) @ 2.5 ml / L water (51.01 %). On the otherhand, the lowest reduction of lady bird beetle abundance over control was found in Neemoil (fresh) @ 2.5 ml / L water (21.99 %) which was folloed by Curtup 50 SP @ 2.0 g / L water (37.56 %), Emamectin benzoate 5 SG @ 1.0 g / L water (45.69 %) and Fenitrothion 50 EC @ 1 ml / L water (46.39%).

The above results thus conclude that Neemoil (fresh) @ 2.5 ml / L water (22.45/plot), Curtap 50 SP @ 2.0 g / L water (17.97 / plot) and Emamectin benzoate 5 SG @ 1.0 g / L water (15.63/plot) are safe but Fenvalerate 20 EC @ 1.0 ml / L water(10.67/plot), Cypermethrin 10 EC @ 1.0 ml / L water (11.43/plot) and Esfenvelarate 5 EC @ 1.0 ml / L water (12.72/plot) are toxic for the lady bird beetle in the country bean field during summer season.

Mahmudunnabi *et al*. [10] found that lady bird beetle was highly abundant (27.05 %) among different predaceous insects and spiders in the chick pea field.

Effect of Insecticides for the Mortality Lady Bird Beetle at Country Bean Field: Both the synthetic and natural insecticides have detrimental effect on lady bird beetle population as shown in table 2. Toxicity of any insecticide is expressed by the mortality rate of insects after its application. Among the insecticides applied, highest number of dead lady bird beetle was collected from Curtap 50 SP @ 2 g / L water (4.45) treated plot which was followed by Esfenvalerate 5 EC @ 1 ml / L water (4.29), Deltrametrin 2.5 EC @ 1 ml / L water (3.96), Cypermethrin

Table 1: Effect of insecticides on the abundance (number / plot) of predatory lady bird beetle in country bean field

Name of the treatments (insecticides) with their dose	Number of lady bird beetle per plot	Percent (%) reduction over control
Cypermethrin 10 EC @ 1 ml / L water	11.43gh	60.28
Fenitrothion 50 EC @ 1 ml / L water	15.43de	46.39
Fenvelarate 20 EC @ 1 ml / L water	10.67 h	62.93
Emamectin benzoate 5 SG @ 1 g / L water	15.63 d	45.69
Deltrametrin 2.5 EC @ 1 ml / L water	13.93 ef	51.60
Esfenvalerate 5 EC @ 1 ml / L water	12.72 fg	55.80
Curtap 50 SP @ 2 g / L water	17.97 c	37.56
Neemoil (fresh) @ 2.5 ml / L water	22.45 b	21.99
Neemoil (stored) @ 2.5 ml / L water	14.10 ef	51.01
Untreated control	28.78 a	
CV	5.25 %	

Values are mean of 3 replications. In a column, means followed by same letter(s) are statistically identical by DMRT at 5% level of significance.

Table 2: Effect of insecticides on the mortality of predacious lady bird beetle in the country bean field

Name of the treatments (insecticides) with their dose	No. of dead lady beetle per plot	Percent mortality of lady beetle
Cypermethrin 10 EC @ 1 ml / L water	3.62 bc	31.76 ab
Fenitrothion 50 EC @ 1 ml / L water	3.29 cd	21.31 de
Fenvelarate 20 EC @ 1 ml / L water	2.70 e	25.31 cd
Emamectin benzoate 5 SG @ 1 g / L water	2.97 de	19.04 e
Deltrametrin 2.5 EC @ 1 ml / L water	3.96 ab	28.42 bc
Esfenvalerate 5 EC @ 1 ml / L water	4.29 a	33.78 a
Curtap 50 SP @ 2 g / L water	4.45 a	24.80 cd
Neemoil (fresh) @ 2.5 ml / L water	2.13 f	9.37 f
Neemoil (stored) @ 2.5 ml / L water	2.46 e f	17.45 e
Untreated control	0.00 g	0.00 g
CV	10.25 %	11.04 %

Values are mean of 3 replications. In a column, means followed by same letter(s) are statistically identical by DMRT at 5% level of significance.

10 EC @ 1 ml / L water (3.62) and Fenitrothion 50 EC @ 1 ml / L water (3.29) while the lowest number of dead lady bird beetle was recorded from untreated control plot (0.00) followed by Neemoil (fresh) @ 2.5 ml / L water (2.13), Neemoil (stored) @ 2.5 ml / L water (2.46), Fenvelarate 20 EC @ 1 ml / L water (2.70) and Emamectin benzoate 5 SG @ 1 g / L water (2.97). In the untreated control plot, the dead lady bird beetle found zero as no insecticide was applied and drifting of other insecticides was protected.

For percent mortality of lady bird beetle, the highest was observed in Esfenvalerate 5 EC @ 1.0 ml / L water (33.78%) treated plot which was followed by Cypermethrin 10 EC @ 1.0 ml / L water (31.76 %), Deltramethrin 2.5 EC @ 1.0 ml / L water (28.42 %), Fenvelarate 20 EC @ 1 ml / L water (25.31%) and Curtap 50 SP @ 2 g / L water (24.80%). On the contrary, the lowest percent mortality was obtaioned from Neemoil (fresh) @ 2.5 ml / L water (9.37 %) treated plot which was followed by Neemoil (stored) @ 2.5 ml / L water (17.45 %), Emamectin benzoate 5 SG @ 1.0 g / L water (19.04 %) and Fenitrothion 50 EC @ 1.0 ml / L water (21.31 %) after the untreated control plot where the value found zero. As the control plots were not treated by any insecticides, the percent mortality of lady bird beetle found zero.

Therefore, the above results revealed that among the insecticides, Neemoil (fresh) @ 2.5 ml / L water, Neemoil (stored) @ 2.5 ml / L water and Emamectin benzoate 5 SG @ 1.0 g / L water found safe for the predaceous lady bird beetle. Ganapathy and Durairaj [11] reported that Thiodan 35 EC (Endosulfan) and Metasystox 25 EC (demeton-S-methyl) were less toxic to larvae of lady bird beetle (*Menochilus sexmaculatus*), a predator of *Aphis craccivora* in cowpeas. Hassan [12] observed that Shobicron 425 EC, Ripcord 10 EC and Cymbush 10 EC seem to be relatively less toxic against ladybird beetles. The larval stage of the ladybird beetle was found more susceptible than the adults. Singh *et al*. [13] reported that Endosulfun was highly effective against *Aphis crassivora* as well as safest to the aphid predator *Coccinella septempunctatra*. Islam and Sarder [14] reported that Diazinon and Nogos @ 2ml/L water resulted in 86.7% and 83.3% larval mortality and similarly 86.7% and 93.3% adult mortality respectively.

CONCLUSIONS

In the untreated control plots the number of lady bird beetle was more than treated plots. Among the insecticides Neemoil (fresh) @ 2.5 ml / L water, Neemoil (stored) @ 2.5 ml / L water and Emamectin benzoate 5 SG @ 1.0 g / L water found safe to lady bird beetle but Esfenvalerate 5 EC @ 1 ml / L water, Cypermethrin 10 EC @ 1 ml / L water and Deltrametrin 2.5 EC @ 1 ml / L water found toxic to lady bird beetle as the percent mortality by these insecticides found least and highest respectively.

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