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Short Communication

Relative efficacy of some insecticides for the control of tea mosquito bug, *Helopeltis theivora* (Waterhouse) in Bangladesh

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Tea mosquito bug, *Helopeltis theivora* Waterhouse (Hemiptera: Miridae) is one of the most serious pests of tea in Bangladesh. It is also widely distributed in India, Sri Lanka, Vietnam, Indonesia, Malaysia and Africa. It is also a phytophagous pest of coffee, cocoa, cashew etc. A group of genomes are treated as a mosquito bug. This bug bears no relation to mosquito and the name 'Tea Mosquito Bug' is simply a misnomer. It is considered as one of the major pests of Bangladesh tea because it attacks only to the young shoots that are the actual crop of tea. Ahmed (2) reported that 10 -15% of tea crop is lost annually by *Helopeltis* which sometimes may go up to 100% crop loss. Both the nymphs and adults damage the plant by sucking sap from young leaves, buds and tender stems. Due to intensive feeding by nymphs and adults, leaves curl up and are badly deformed. In addition to direct crop loss, damage by *Helopeltis* leads to debilitation of bushes resulting in die-back with crows-feet and delayed or meager flushing thereafter consequently almost the entire crop is lost. Mamun (6) described that many different tactics are used in IPM strategy for tea mosquito bug in tea plantation, including cultural practices, biological control agents, pest-resistant varieties, physical barriers and chemical pesticides etc. Yet chemical insecticides have remained as the most powerful tools for controlling this pest in Bangladesh. From the above point of view, efforts were made to evaluate the relative efficacy and economic analysis of some insecticides to find out suitable substitute for efficient control of tea mosquito bug in Bangladesh tea.

The experiment was carried out at Bilashcherra Experimental Farm of Bangladesh Tea Research Institute (BTRI), Srimangal, Moulvibazar during the cropping period from June to August, 2010. Nine treatments were laid out in a Randomized Completely Block Design (RCBD) with 10m x 5m plot size each having 50 bushes and each treatment was replicated thrice. Treatments were T_1-Thiamethoxam (Spike 25 WG) @ 0.125 kg/ha, T_2-Carbaryl (Kalvin 85 WP) @ 1.0 kg/ha, T_3-Quinalphos+Cypermethrin (Viraat 23 EC) @ 0.625 L/ha, T_4-Lambda Cyhalothrin (Agrostar 2.5 EC) @ 0.50 L/ha, T_5-Phenthoate (Bilsun 50 EC) @ 0.50 lit/ha, T_6-

Abamectin (Sunmectin 1.8 EC) @ 0.50 L/ha, T_7 -Quinalphos (Phinacol 25 EC) @ 1.0 L/ha, T_8 -Endosulfan (Thiodan 35EC) @ 1.5 L/ha and T_9 - (Untreated Control). The insecticides were sprayed with Knapsack Hand Sprayer (CP 15) in 500L/ha of water. All the chemicals were applied in the experimental plots as recommended dose of BTRI prescribed by Mamun & Ahmed (5). The first spray was done on the 3rd of June and second as well as third applications were done after 3 weeks and 6 weeks intervals, respectively after first spray. If 5% pluckable shoots are infested i.e. ETL value of *Helopeltis* only then insecticides should be applied according to Mamun & Ahmed (4). Therefore, the first application of the insecticides was made at this time. Pre-treatment data was taken before spraying of chemicals. Afterwards, at an interval of 7 days, the post-treatment data such as per cent shoot infestation as well as total shoot weight were recorded and a total of twelve weeks data were recorded. Relative field efficacy of the selected pesticides against tea mosquito bug was calculated by using Henderson & Tilton (3) formula. Yield of the respective treatment plots were converted into yield per hectare. The economic analysis by using partial budgeting technique was carried out to find out the economically viable insecticide against tea mosquito bug followed by Perrin *et al* (7). Data were analyzed using MSTAT statistical software in a microcomputer.

The comparative effectiveness of various treatments on the shoot infestation and yield of tea crop has been presented in Table 1. All the treatments significantly reduced percent shoot infestation as well as increased yield as compared to untreated control. The results revealed that the highest shoot infestation (42.26%) was obtained in the untreated control significantly ($P<0.05$). The lowest shoot infestation and the highest per cent effectiveness were obtained from the plot treated with (Quinalphos+Cypermethrin) (4.41% & 86.16%) followed by that of Thiamethoxam (4.52% & 85.90%) and Lambda Cyhalothrin (4.78% & 85.75%) treated plots respectively. The highest yield of tea crop was obtained in (Quinalphos+Cypermethrin) treated plot (1905.37 kg/ha) with no significant difference between the plot treated with Thiamethoxam (1890.48 kg/ha). Significantly the lowest yield was obtained in untreated control (1521.45 kg/ha).

The highest gross return of Tk 384089.73/ha was obtained in (Quinalphos+Cypermethrin) treated plots followed by Thiamethoxam (380326.44 Tk/ha), Quinalphos (373577.89 Tk/ha), Lambda cyhalothrin (372134.08 Tk/ha), Carbaryl (364254.46 Tk/ha), Abamectin (364203.44 Tk/ha), Phenthoate (363481.10 Tk/ha) and Endosulfan (361199.71 Tk/ha) treated plots (Table 2). It indicates that the treatments of Thiamethoxam, Phenthoate, Carbaryl and Endosulfan with variable cost of

2250, 1950, 2100 and 2700 taka, respectively were cost dominated due to its higher cost compared to lower gross margin. So these four treatments were eliminated for further analysis. The performances of cost-undominated treatments were shown through marginal analysis in Table 3. It was observed that (Quinalphos+Cypermethrin) showed the highest marginal rate of return (5313.62%) followed by Phenthoate (5293.83%), Lambda Cyhalothrin (5287.09%) and Abamectin (963.12%). It indicates that if the planters spend an additional one hundred taka more by applying Quinalphos+Cypermethrin, they can get an extra income of Tk. 5313.62 over the control. In an earlier studies, Ahmed *et al* (1) obtained highest marginal rate of return by spraying Oxydemeton-methyl for controlling tea mosquito bug, *Helopeltis theivora*.

Infestation of shoot reduction as well as yield was the highest in Quinalphos+Cypermehtrin treated plots. From the economic point of view, the combination insecticide of Quinalphos+Cypermehtrin showed the highest marginal rate of return in comparison to all other insecticides. So, Quinalphos + Cypermethrin @ 0.625 lit/ha is the most economically acceptable insecticide for controlling tea mosquito bug and thus the chemical should be incorporated in pest management programme for sustainable protection in tea.

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Table 1.
Relative efficacy of different treatments on the shoot infestation by tea mosquito bug during the period from June to August, 2010

Treatments	Dose/ha	Mean shoot infestation (%)		Overall effective-ness (%)	Average Yield (Kg/ha)	% increase in yield over control
		Pre-Treatment	Post-treatment			
T_1 -Thiamethoxam	0.125 kg	20.77	4.52	85.90a	1890.48a	24.26
T_2 - Carbaryl	1.0 kg	20.47	5.12	82.89b	1810.32c	18.99
T_3 -Quinalphos+Cypermethrin	0.625L	24.02	4.41	86.16a	1905.37a	25.24
T_4 -Lambda cyhalothrin	0.5L	17.23	4.78	85.75a	1845.18b	21.28
T_5 -Phenthoate	0.5L	16.71	5.57	83.23b	1801.31c	18.40
T_6 -Abamectin	0.5L	17.03	6.23	81.18c	1805.25c	18.66
T_7 -Quinalphos	1.0L	17.71	5.36	83.37b	1855.65b	21.97
T_8 -Endosulfan	1.5L	20.60	7.18	80.40c	1798.19c	18.19
T_9 -(Untreated control)	-	22.05	42.26	-	1521.45d	-

Mean of 3 replications. Figures in a column having the same letter are statistically identical (P>0.05).

Table 2.
Partial budget of different insecticidal treatments applied for controlling tea mosquito bug in mature tea

Insecticides	Dose/ha (Kg or L)	Average yield (Kg/ha)	Variable cost (Tk/ha)	Gross return[1] (Tk/ha)	Gross margin[2] (Tk/ha)
T_1 -Thiamethoxam	0.125	1890.48	2250	382576.44	380326.44
T_2 - Carbaryl	1.0	1810.32	2100	366354.46	364254.46
T_3 -Quinalphos+Cypermethrin	0.625	1905.37	1500	385589.73	384089.73
T_4 -Lambda Cyhalothrin	0.5	1845.18	1275	373409.08	372134.08
T_5 -Phenthoate	0.5	1801.31	1050	364531.10	363481.10
T_6 -Abamectin	0.5	1805.25	1125	365328.44	364203.44
T_7 -Quinalphos	1.0	1855.65	1950	375527.89	373577.89
T_8 -Endosulfan	1.5	1798.19	2700	363899.71	361199.71
T_9 -(Untreated control)	-	1521.45	-	307895.84	307895.84

Cost of insecticides: Thiamethoxam @ Tk. 6000/kg, Carbaryl @ Tk. 700/kg, Quinalphos+Cypermethrin @ Tk. 800/L, Lambda cyhalothrin @ Tk. 850/L, Phenthoate @ Tk. 700/L, Abamectin @ Tk. 750/L, Quinalphos @ Tk. 650/L and Endosulfan @ Tk 600/L

Average auction price of made tea (BTRI) in 2010 @ 202.37 Tk/kg

[1]Gross return: yield x price of a particular product, [2]Gross margin: gross return – total variable cost

Table 3.

Marginal analysis of different insecticidal treatments applied for controlling tea mosquito bug in mature tea

Insecticides	Gross margin (Tk/ha)	Variable cost (Tk/ha)	Marginal Gross margin[1] (Tk/ha) (a)	Marginal variable cost[2] (Tk/ha) (b)	Marginal rate of return (%) (a/b x 100)
T_3-Quinalphos+Cypermethrin	384089.73	1500	11955.65	225	5313.62
T_4-Lambda cyhalothrin	372134.08	1275	7930.64	150	5287.09
T_6-Abamectin	364203.44	1125	722.34	75	963.12
T_5 - Phenthoate	363481.10	1050	55585.26	1050	5293.83
T_9 (Untreated Control)	307895.84	-	-	-	-

[1]Marginal Gross margin: The increase in revenue of a farm caused by increasing one extra unit of inputs. [2]Marginal Variable Cost: The increase in the variable cost of a farm caused by increased output by one extra unit.