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RESEARCH ARTICLE

ECO-FRIENDLY MANAGEMENT OF RICE YELLOW STEM BORER, *SCIRPOPHAGA INCERTULUS* (PYRALIDAE: LEPIDOPTERA) THROUGH REDUCING RISK OF INSECTICIDES

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ABSTRACT

A study was conducted during the period of January to July, 2012 in the Entomology Field Laboratory, Bangladesh Agricultural University, Mymensingh to manage the Yellow Stem Borer (YSB) of rice eco-friendly following the Randomized Complete Block Design (RCBD) with four replications using the rice variety TN1. To keep in view this point, three insecticides viz. Dursban 20 EC, Convoy 25 EC, Belt 24 WG and three botanical extracts viz. Neem, Tobacco, Karanja extracts were used to compare their effectiveness against Yellow Stem Borer (YSB),*Scirpophaga incertulus* and also against natural enemies of Yellow Stem Borer (YSB) as Yellow Stem Borer (YSB),*Scirpophaga incertulus* causes dead heart and white head symptoms at vegetative and reproductive stage of rice respectively, the number of dead heart and white head symptoms were counted at different time interval viz. 7, 15, 21 days after spraying (DAS) to assess the effectiveness of the treatments. The chemicals and botanicals caused significant difference in their effects against Yellow Stem Borer (YSB). Among the chemicals Dursban 20 EC caused highest reduction in dead heart and white head symptoms and in case of botanicals Neem extracts caused highest reduction in the symptoms. The chemicals and botanicals were also evaluated for their side effects on natural enemies of rice. The botanicals were found less harmful than insecticides. Natural enemies like Lady Bird Beetle and Spider were abundant in the Neem extract sprayed rice field after several weeks of its application. The insecticides and botanicals reduced the infestation of Yellow Stem Borer (YSB), *Scirpophaga incertulus* and thereby significantly influenced the yield performance of rice. Dursban 20 EC treated plot showed highest yield (1.80 Kg/ plot) and Neem extract treated plot showed the yield 1.40 Kg/ plot. Considering the efficacy and eco-friendly nature of Neem extracts it could be considered as an effective botanicals in successful management of the pest Yellow Stem Borer (YSB), *Scirpophaga incertulus* of rice.

KEYWORDS

Rice Yellow Stem Borer, Eco-friendly, Management.

1. INTRODUCTION

Bangladesh, one of the smallest countries (area 57 K sq. miles) in South-East Asia, has a predominantly farming-based economy. Agricultural land per capita is decreasing over the years in Bangladesh (BBS, 2012). Agriculture and environment are closely interlinked. Agricultural production system depends on the environment for utilization of land, rainfall, daylight duration, insect pests and diseases. Pest problem is one of the major constraints for achieving higher production in agriculture crops. Bangladesh loses about 30% of its crops due to pests and diseases each year (BBS, 2012). Rice (*Oryza sativa* L.) is an important food crop which supplies staple food for nearly 50% of the global population (Fao, 2011; Garris et al., 2005). Among the most cultivated cereals in the world, rice ranks as second to wheat. Stem borers (SBs) are key group of insect pests of rice. Among the borers, yellow stem borer (YSB), *Scircophaga incertulas*is distributed throughout Indian sub-continent and is regarded as the most dominating and destructive pest species (Mahar et al., 1985). Severe infestation by YSB often results in complete crop failure (Kushwaha, 1995). Yellow stem borer *S. incertulas* usually comprised more than 90% of the borer population in rice field, particularly in Bangladesh. Farmers in Bangladesh depend on synthetic insecticides because they are readily available, highly promoted, inexpensive, easy to apply and quick acting. However, applied insecticides also kill non-target arthropods, typically insects involved in pollination and predators such as spiders and ground beetles. Insecticide residues find their way into water resources, particularly in rice cultivation, and affect the water we drink and food we eat (Cork and Krishnaiah, 2000; Cork et al., 2001). Furthermore, quite often the indiscriminate and unscientific use of

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pesticides has led to many problems, such as pests developing resistance, resurgence of once minor pest into a major problem besides environmental and food safety hazards. In such a back drop bio-pesticides are reported to be safer to human health imparting no ecological toxicity (Ketkar, 1976). Though the efficacy of neem derivatives and a few other bio-pesticides on YSB incidence have been tested elsewhere, it has resulted only in a variable range of success (Ganguli and Ganguli, 1998). The neem seed kernel extract (NSKE) is known to suppress the feeding, growth and reproduction of insects due to its biochemicals (Natarajan and Sundaramurthy, 1990). Neem products can be recommended for many programmes on integrated pest management (Juan et al., 2000; Calvo and Molina, 2003). *Vitexnegundo* L. (Verbenaceae) has shown a promising pesticidal activity against insects and is widely used for its pest control properties (Hern'Andez et al., 1999). Miranpuri and Kacharourian have also reported the efficacy of some bio-pesticides for pest suppression (Miranpuri and Kachatourian, 1993). In this consideration efficacy of different pesticide formulation on the YSB incidence in diverse Agro-ecological zone is needed to be explored (Kushwaha, 1995). In view of this and to evaluate the relative efficacy of 11 selected insecticide formulations against YSB incidence, a study was undertaken for three consecutive years (2007-2009) where no such experiment even of preliminary in nature was carried out earlier. Considering the above facts the present research work is designed to manage the yellow stem borer eco-friendly by using bio-pesticides.

2. Materials and Methods

For conducting this present research work, methods and procedures were followed that are described under the following the sub-heads:

2.1 Location and Time of the Study

The experiment of the research was conducted in the Entomology Field Laboratory of Entomology Department, Bangladesh Agricultural University, Mymensingh. The period of the study was from 10th January to 17th July, 2012.

2.2 Characteristics of Soil

The soil of the experimental area was silty loam belonging to the Old Brahmaputra Floodplain Alluvial Tract under the Agro Ecological Zone 9 (FAO, 2011). The selected site was a well-drained medium high land having soil pH 6.8. The nutrient status of the soil under the experimental plot at depth of 0-30 cm was analyzed at the Humboldt Soil Testing Laboratory, Department of Soil Science, Bangladesh Agricultural University, Mymensingh.

2.2.1 Weather

The experimental area was characterized by tropical rainfall during the month of March to June and scattered rainfall during the rest of the year. Monthly minimum and maximum temperature, relative humidity, total rainfall and total sunshine were recorded during the period of the present study (Appendix I).

2.2.2 Planting Material

For testing the effectiveness of botanical extracts and chemical pesticides in the experimental plots for controlling yellow stem borer (YSB), TN1 rice variety were used. After transplanting seedlings, recommended agronomic practices and fertilizer dose were applied.

2.3 Treatments

Table 1: List of chemicals and botanicals with doses

Treatments	Doses
T_1- Dursban 20EC	4ml/litre of water
T_2 -Convoy 25 EC	3ml/litre of water
T_3 – Belt 24WG	500g/hectare
T_4- Neem Extracts	15ml/ L
T_5 – Tobacco Extracts	15ml/ L
T_6 – Karanja Extracts	15ml/ L
T_7 – Control (untreated)	----------

The test insecticides were applied thrice, first at the tillering stage and the second at the panicle initiation stage. At each application, plants were sprayed to run-off point. Dead heart counts were taken 35 days after transplanting by counting the number of tillers showing dead heart in ten alternate stands taken diagonally in each plot. The total numbers of tillers in the same ten stands were also counted, a method used. White head counts were taken 60 days after transplanting from ten alternate stands, which taken diagonally in the plots. The total numbers of productive tillers in the same ten stands were counted. The percentage dead hearts and white heads were computed by using formula (Abbott, 1925).

2.4 Design of the Field Experiment

In field, the above 5 treatments were laid out in a Randomized Complete Block Design (RCBD) with 4 replications arranged in field plots. Thus, there were 20 (5×4) unit plots altogether in the experiment. Distance between replication to replication was 0.60 m. Border between the plots was 0.60 m to facilitate different intercultural operations (Figure 5).

2.5 Collection of Test Insecticides

2.5.1 Dursban 20EC

Common name: Chlorpyrifos. Properties: Chlorpyrifos is a broad-spectrum organophosphate insecticide. It is used as an insecticide on grain, cotton, field, fruit, nut and vegetable crops, and as well as on lawns and ornamental plants. It is a systemic and contact insecticide. Chlorpyrifos acts on pests primarily as a contact poison, with some action as a stomach poison. It is available as granules, wet table powder, dust and emulsifiable concentrate. It inhibits an enzyme of the nervous system (acetylcholine esterase). This causes convulsions and paralysis.

2.5.2 Convoy 25 EC

Common name: Quinalphos
Properties: Quinalphos effectively controls caterpillars on fruit trees, cotton, vegetables and peanuts; scale insect on fruit trees and pest complex on rice. Quinalphos also controls aphids, bollworms, borers, leafhoppers, mites, thrips, etc. on vines, ornamentals, potatoes, soya beans, tea, coffee, cocoa, and other crops.

2.5.3 Belt 24 WG

Common name: Flubendiamide. Properties: Insecticide for the control of lepidopteran larvae in tomato, pepper greenhouse. The flubendiamide belongs to a new chemical class of phthalic diamides and has a new mode of action at the biochemical level without showing cross resistance with any of the known groups of insecticides. Actsby activating receptors ryanodine (ryanodine receptor modulator) thus preventing the operation of the muscular system, paralysis and death of insects.

2.6 Plant Extracts Preparation

2.6.1 Neem (Azadirachtaindica) extract

Leaves and small branches of neem (5 kg) were cut into small pieces and mixed with 10 liter water. The water was boiled for 30-50 minutes. The solution was kept to become cool for about 2 hours then filtered.

2.6.2 Tobacco (Nicotianatabacum) extract

The tobacco leaf (3kg) was purchased from shop and mixed with 8 liters of water, which was boiled for 30-50 minutes, the solution was allowed to cool for about 2 hours then filtered.

2.6.3 Karanja (Pongamiaglabra) extract

Leaves and small branches of Karanja (5 kg) were cut into small pieces and mixed with 10 liter water. The water was boiled for 30-50 minutes. The solution was kept to become cool for about 2 hours then filtered.

2.7 Methodology for Testing Botanicals and Chemical Insecticide

2.7.1 Insecticides effectiveness of three selected insecticides in controlling yellow stem borer

Test Insecticides were sprayed to control the yellow stem borer. The effectiveness of the insecticides on the yellow stem borer population was recorded. The experiment was designed in a Randomized Complete Block Design in the standing rice plant and was replicated 3 times. Each insecticide was tested with a single dose and efficiency of the dose on yellow stem borer was compared. The spraying of insecticide doses was done in March 2012 at 35 days after transplanting for dead heart counting and 60 days after transplanting for white head counting with the help of a hand-operated sprayer it was sprayed. Care was taken to avoid spray drift on adjacent plots. The spraying was done in such a way that the spray droplet did not coalesce and drain down in the soils and whole plant was thoroughly covered by spray material. After spraying each insecticide with designed dose the sprayer was washed and cleaned properly. Before, each application, the sprayer was calibrated in order to use the right dose on the plants without wastage of insecticides by determining the quantity of water required for each plot. The control plots were not sprayed with anything.

2.7.2 Efficacy of three selected botanical extracts in controlling yellow stem borer of rice

The efficacy of three botanical extracts viz., neem extract, tobacco extract and karanja extract, each having single dose along with control was tested against yellow stem borer, *Scirpophaga incertulus* on standing rice plant at the place of Bangladesh Agricultural University Campus, Mymensingh. The trial was conducted in a Randomized Complete Block Design and was replicated 3 times. Each botanical extract was tested at the dose of 15 ml/L and efficacy of the doses on yellow stem borer was compared. The spraying of botanical extracts was done in March 2012 at 35 days after transplanting for dead heart counting and 60 days after transplanting for white head counting with the help of a hand-operated sprayer. Care was taken to avoid spray drift on adjacent plants. The spraying was done in such a way that the spray droplet did not coalesce and drain down in the soils and whole plot was thoroughly covered by spray material. After spraying each botanical extract with designed dose the sprayer was washed and cleaned properly. Before, each application, the sprayer was calibrated in order to use the right dose on the plants without wastage of botanical extracts by determining the quantity of water required for rice plant. The control plots were not sprayed with anything. Pre-treatment data were recorded one day before application of botanical extract. For recording the data 10 hills were randomly selected from the plot for respective botanical extracts treatment and 10 hills were observed from each plot. The data on the damage symptoms either dead heart or white head per 10 hills were recorded after 7, 15, 21 days of spraying of chemical and botanical extracts. The presence of natural enemies was also observed at the time of recording the extent of damage. Yield of the treated plots were recorded and compared for their difference. The data were analyzed statistically and the mean values were separated using DMRT.

3. Results and Discussion

Experiments were conducted in developing controlling methods for rice yellow stem borer, *Scirpophagaincertulus* under field condition. Efficacy of insecticides as well as botanicals was evaluated against yellow stem borer, *S. incertulus.* The findings have been presented and discussed under the following sub-heads. Pre-treatment data were recorded before the application of chemical insecticides and botanicals. The availability of rice yellow stem borer, extent of damage caused by pest and effectiveness of treatments to control the target insect was evaluated by counting the pre-treatment dead heart and white head symptoms.

3.1 Effect of Insecticides on Infestation of Rice Yellow Stem Borer after Different Days after Spraying

3.1.1 Data on dead heart and white head symptoms before and after applications of botanicals and chemical insecticides

Pre-treatment data for dead hearts and white heads revealed that all the plots of respective treatments were not significant (NS). The number of dead hearts observed in plots of dursban 20 EC, convoy 25 EC and belt 24 WG was1.74 (Table 2). The number of dead hearts observed in plots of neem extracts, tobacco extracts and karanja extract was 1.75 and (Table 2). And that for the control was 1.73. The analysis of the data regarding pretreatment effect for dead hearts revealed that all the plots of respective treatments were not significant before treatment. After obtaining of pre-treatment data plants which showed both symptoms were removed from the plot and then the data of post-treatment were collected.

Table 2: Effect of different botanical extracts and chemical insecticides on damage of yellow stem borer at different days after spraying.

Treatment	Mean number of dead heart and white head at different time intervals							
	Pre-treatment		7 Days after spraying		15 Days after spraying		21 Days after spraying	
	Dead heart	White head	Dead heart	White head	Dead heart	White head	Dead heart	White head
Dursban 20 EC	1.74	3.92	1.38b	2.51b	1.00b	1.89b	0.63b	1.69b
Convoy 25 EC	1.74	4.20	1.58ab	2.92ab	1.33a	2.98a	1.22b	2.74ab
Belt 24 WG	1.74	3.98	1.52ab	2.89ab	1.28ab	2.86ab	1.19b	2.71ab
Neem extract	1.75	3.67	1.42b	2.98ab	1.05b	2.40ab	0.89ab	1.74b
Tobacco extract	1.75	3.19	1.71ab	3.83a	1.57a	3.96a	1.38ab	3.70ab
Karanja extract	1.75	3.18	1.69ab	2.80ab	1.38a	2.97a	1.30ab	3.23ab
Control	1.73	3.71	1.87a	4.80a	2.44a	3.92a	2.39a	4.77a
LSD	NS	NS	**	**	**	**	*	*
CV (%)			7.59	12.56	11.78	11.96	4.92	10.09

- Means in a column followed by same letter(s) are not significantly different.
- ** indicates significance at 1% level, * indicates 5% level of significance.
- NS= non-significant

3.1.2 Effect of Botanical Extracts and Chemical Insecticides on Dead heart Symptom of Rice after 7 DAS

The number of dead hearts was significantly influenced by the application of botanical extracts and insecticides after 7 days after spraying (Table 2). The maximum dead heart symptom was observed in case of control (1.87) which was followed by tobacco extract and karanja extract application, whereas the minimum was observed in case of dursban 20 EC (1.38) which was followed by neem extract and Belt 24 WG application (Table 2). The maximum reduction percent of dead heart was observed in dursban 20 EC (20.68%) which was followed by neem extract (18.85%) and belt 24 WG (12.64%) (Table-3). A similar result was found, neem extract showed a reduction of 15.59%, which was statistically similar with dursban 25 EC (Panda *et al.,* 2004). The botanical Tobacco extract reduced only 2.28%, which was statistically similar with karanja extract 3.84%. In case of control the dead heart percent was increased by 8.09%.

3.1.3 Effect of Botanical Extracts and Chemical Insecticides on Dead Heart Symptoms of Rice after 15 DAS

Effect of botanical extracts and insecticides on dead hearts after 15 days after spraying was significant at 5% level (Table 2). The maximum dead heart symptom was observed in case of control (2.44) which was followed by tobacco extract and karanja extract application, whereas the minimum was observed in case of dursban 20 EC (1.00) which was followed by neem extract and belt 24 WG (Table 2). The maximum reduction percent of dead heart was observed in dursban 20 EC (27.53%) which was followed by neem extract (26.05%) and karanja extract (18.34%) (Table-3). A similar

result was found (Mayabini, 2004). The effect of dursban 20 EC was statistically similar with neem extracts 26.05%. Convoy 25 EC caused 15.82% reduction which was identical with karanja extract 18.34%. In case of control the dead heart percent was increased by 30.48%.

Table 3: Effect of different chemical insecticides and botanical extracts on reduction or increase of dead heart of rice at different days after spraying (DAS)

Treatment	Reduction or increase of dead heart at different time intervals		
	% dead heart at 7 DAS	% dead heart at 15 DAS	% dead heart at 21 DAS
Dursban 20 EC	-20.68a	-27.53a	-37.00a
Convoy 25 EC	-9.19bc	-15.82bc	-8.27c
Belt 24 WG	-12.64b	-15.78bc	-7.03cd
Neem extract	-18.85a	-26.05a	-15.23b
Tobacco extract	-2.28d	-8.18d	-12.10b
Karanja extract	-3.48d	-18.34b	-5.79d
Control	8.09bc	30.48a	-2.04e
LSD	**	**	*

- % Reduction / increase were calculated using the pretreatment mean data of dead heart.
- Negative sign (-) indicate % of reduction while positive sign (+) indicate % of increase in dead heart.
- DAS = Days after spraying.
- Means in a column followed by same letter (s) are not significantly different.
- ** indicates significance at 1% level, * indicates 5% level of significance.

3.1.4 Effect of Botanical Extracts and Chemical Insecticides on dead heart symptom of rice after 21 DAS

Effect of botanical extracts and insecticides on dead hearts after 21 days after spraying was significant at 5% level (Table 2). The maximum dead heart symptom was observed in case of control (2.39) which was followed by tobacco extract and karanja extract, whereas the minimum was observed in case of dursban 20 EC (0.63) which was followed by neem extract and belt 24 WG application (Table 2). The maximum reduction percent of dead heart was observed in dursban 20 EC (37.00%) which was followed by neem extract (15.23%) and tobacco extract (12.10%) (Table-3). A similar result was found by Sheng-Cheng. Belt 24 WG reduced 7.03% dead heart symptom that was statistically similar with karanja extract (5.79%). In case of control the dead heart percent was reduced by 2.04%.

3.1.5 Effect of Botanical Extracts and Chemical Insecticides on White Head Symptoms of Rice after 7 DAS

The number of white head was significantly influenced by the application of botanical extracts and insecticides after 7days after spraying (Table 2). The maximum white head symptom was observed in case of control (4.80) which was followed by tobacco extract and neem extract, whereas the minimum was observed in case of dursban 20 EC (2.51) which was followed by karanja extract and belt 24 WG (Table-2). The maximum reduction percent of white head was observed in dursban 20 EC (35.96%) which was followed by convoy 25 EC (30.47%) and belt 24 WG (27.38%) (Table-4). A similar result was found (Firake *et al.,* 2010). In case of control the white head percent was increased by 29.38%.

3.1.6 Effect of botanical extracts and chemical insecticides on white head symptom of rice after 15 DAS

Effect of botanical extracts and chemical insecticides on white head after 15 days after spraying was significant at 5% level (Table 2). The maximum white head symptom was observed in case of tobacco extract (3.96) which was followed by control and karanja extract application, whereas the minimum was observed in case of dursban 20 EC (1.89) which was followed by neem extract and belt 24 WG (Table-2). The maximum reduction percent of dead heart was observed in dursban 20 EC (24.70%) which was followed by neem extract (19.46%) and control (18.33%) (Table-4). A similar result was found (Mayabini, 2004). The effect of dursban 20 EC was statistically similar with neem extracts 19.46%.

Table 4: Effect of different chemical insecticides and botanical extracts on reduction or increase of white head symptoms at different days after spraying (DAS)

Treatment	Reduction or increase of white head at different time intervals		
	% white head at 7 DAS	% white head at 15 DAS	% white head at 21 DAS
Dursban 20 EC	-35.96a	-24.70a	-10.58b
Convoy 25 EC	-30.47a	2.05d	-8.05b
Belt 24 WG	-27.38ab	-1.03d	-5.24c
Neem extract	-18.80cd	-19.46ab	-27.50a
Tobacco extract	20.06c	3.39cd	-6.50c
Karanja extract	-11.94d	6.07c	8.75b
Control	29.38a	-18.33ab	21.68a
Level of significance	**	*	*

- % Reduction / increase were calculated using the pretreatment mean data of dead heart.
- Negative sign (-) indicate % of reduction while positive sign (+) indicate % of increase in dead heart.
- DAS = Days after spraying.
- ** indicates significance at 1% level, * indicates 5% level of significance.
- Means in a column followed by same letter(s) are not significantly different.

3.1.7 Effect of botanical extracts and chemical insecticides on white head symptom of rice after DAS

Effect of botanical extracts and chemical insecticides on white head after 21 days after spraying was significant at 1% level (Table 2). The maximum white head symptom was observed in case of control (4.77) which was followed by tobacco extract and karanja extract, whereas the minimum was observed in case of dursban 20 EC (1.69) which was followed by neem extract and belt 24 WG (Table-2). The maximum reduction percent of white head was observed in neem extract (27.50%) which was followed by dursban 20 EC (10.58%) and convoy 25 EC (8.05%) (Table- 4). Similar result was found by Sheng-Cheng. In case of control the white head percent was increased by 21.68%.

3.2 Effect of Different Botanical Extracts and Chemical Insecticides on Natural Enemies of Rice Yellow Stem Borer, *S. incertulus*

3.2.1 Effect of different botanical extracts and chemical insecticides on lady bird beetle

The data on the number of lady bird beetle with different days after spraying (DAS) were presented in Table 5. Before application of botanicals and chemicals, the number of lady bird beetle among different plots was not significant. Due to cause of applying chemicals viz. dursban 20 EC, convoy 25 EC and belt 24 WG, the number of lady bird beetle decreased. In case of neem extract application the number of lady bird beetle increased with time interval. But it decreased in case of karanja and tobacco extracts. A similar result was found (Misra and Parida, 2004; Agrios, 1988; Brouwer, 2001; Catling, 1992; Catling et al., 1984; Fernando, 1964; International Congress of Entomology, 2004). After 7 days after spraying of synthetic chemicals and botanicals, there was significant variation in the number of lady bird beetle in different treatments. The highest number of lady bird beetle was found in case of control (4.00),

which were followed by tobacco extract and that was lowest in case of dursban 20 EC and karanja extract (3.00) application (Ishikura, 1967; Israel and Abraham, 1967; Judenco, 1972; Kalode, 2005; Koehler, 1971). The variation in the number of lady bird beetle due to various treatments was significant at 1% level of probability at 15 days after application. The highest number of lady bird beetle was found in case of convoy 25 EC and tobacco extract (4.33) which were followed by control (3.86) and that was lowest in case of dursban 20 EC (2.25) and belt 24 WG (2.39) application (Markham *et al.,* 1991; Matteson, 2000). Again the variation in the number of lady bird beetle due to various treatments was significant at 1% level of probability at 21 days after spraying. The highest number of lady bird beetle was found in case of control (4.33) which was followed by neem extract (4.26) and that was lowest in case of karanjaextrct (2.15) which was followed by dursban 20 EC (2.96) application (Mondal, 2010; Naqvi, 1973; Pathak, 1970).

Table 5: Effect of botanical extracts and chemical insecticides on lady bird beetle at different days after spraying (DAS)

Treatment	Number of Lady Bird Beetle			
	Before spray	7 DAS	15 DAS	21 DAS
Dursban 20 EC	3.69	3.00b	2.25b	2.96c
Convoy 25 EC	4.67	3.67b	4.33a	3.33b
Belt 24 WG	3.75	3.25b	2.39b	3.00bc
Neem extract	3.00	3.45b	3.45ab	4.26a
Tobacco extract	4.03	3.96ab	4.33a	3.25b
Karanja extract	3.50	3.00b	2.85b	2.15d
Control	4.0	4.0a	3.86ab	4.33a
Level of significance	NS	**	**	**

- Means in a column followed by same letter(s) are not significantly different
- ** indicates Significance at 1% level, * indicates 5% level of significance.
- NS= Non-significant

3.2.2 Effect of different botanical extracts and chemical insecticides on spider

The data on the number of spider with different days after spraying (DAS) were presented in Table 6. Before application of botanicals and chemicals, the number of spider among different plots was on-significantly differentiated (Pedigo, 1991). After 7 days after spraying of chemicals and botanicals, there was significant variation in the number of Spider due to various treatments. The highest number of spider was found in case of control (4.67) which was followed by neem extract (4.10) and that was lowest in case of dursban 20 EC (1.33) and karanja extract (2.86) application (Qunson, 2011; Ranasinghe, 1992). The variation in the number of spider due to various treatments was significant at 1% level of probability at 15 days after application. The highest number of spider was found in case of control (4.52) which was followed by neem extract (3.94) and that was lowest in case of dursban 20 EC (1.33) and karanja extract (2.17) application. Again the variation in the number of spider due to various treatments was significant at 1% level of probability at 21 days after spraying (Salim *et al.,* 2003). The highest number of Spider was found in case of control (4.52) which was followed by neem extract (3.50) and that was lowest in case of dursban 20 EC (1.67) which was followed by karanja extract (1.98) application.

Table 6: Effect of botanical extracts and chemical insecticides on spider at different days after spraying (DAS)

Treatment	Number of Spider			
	Before spray	7 DAS	15 DAS	21 DAS
Dursban 20 EC	3.33	1.33^{d}	1.33^{d}	1.67^{d}
Convoy 25 EC	3.66	3.33^{b}	3.75^{b}	3.45^{b}
Belt 24 WG	3.25	3.00^{c}	2.85^{bc}	2.76^{c}
Neem extract	3.25	4.10^{a}	3.94^{ab}	3.50^{b}
Tobacco extract	3.19	3.19^{b}	3.75^{b}	3.34^{b}
Karanja extract	3.12	2.86^{c}	2.17^{c}	1.98^{d}
Control	4.50	4.67^{a}	4.52^{a}	4.52^{a}
Level of significance	NS	**	**	**

- Means in a column followed by same letter(s) are not significantly different
- ** indicates Significance at 1% level, NS= non-significant

3.3 Effect on yields by reducing the pest population

Effect on yields also observed at the end of the experiment, by reducing test insect as yellow stem borer, *S. incertulus* of rice by the application of botanical extracts and insecticides. The analysis showed significant variation among the yield due to various treatments (Schwab, 1989). Among the treatments dursban 20 EC showed the best result which was statistically similar with belt 24 WG. The minimum yield was observed at control (1.10)

Table 7: Effects on yield of different treatments by reducing the yellow stem borer population

Treatments	Yield(kg)
Dursban 20EC	1.88^{a}
Convoy 25 EC	1.53^{b}
Belt 24WG	1.80^{a}
Neem extract	1.40^{bc}
Tobacco extract	1.25c
Karanja extract	1.25^{c}
Control	1.10^{d}
Level of significance	**

- Means in a column followed by same letter(s) are not significantly different
- ** indicates Significance at 1% level,
- NS= Not significant

4. CONCLUSION

The experiments were conducted in the Field Laboratory, Department of Entomology, Bangladesh Agricultural University, Mymensingh during the period from 10th January to 17th July 2012. This experiment was conducted to find out the comparative efficacy of different botanical extracts and chemical insecticides against of yellow stem borer, *S. incertulas*. Three botanical extracts viz., tobacco, neem and karanja extract at 15ml/L concentration and three insecticides viz., dursban 20 EC @ 2g/L , convoy 25 EC @ 2g/L and belt 24 WG @ 2 ml/L, and untreated control were included in this field test. The effect of those botanical extracts and chemical insecticides on natural enemies and yields performance was also determined.The reduction of dead heart and white head varied significantly with time interval due to various treatments. Cumulative toxicity increased with the increase of time. Among the insecticides dursban 20 EC was most effective than convoy 25 EC and belt 24 WG in controlling yellow stem borer (YSB). In case of botanicals neem extracts was more effective than tobacco and karanja extract. Efficacy of the insecticides was high after first application but it reduced gradually in course of time.

In case of botanicals contradictory incident was happened.The effect of insecticides and botanicals on natural enemies of yellow stem borer (YSB) was also examined to assess the treatments whether it was eco-friendly or not. The number of natural enemies of yellow stem borer (YSB) such as lady bird beetle and spider was varied significantly with time interval due to different treatments. In case of insecticides, the number of lady bird beetle and spider reduced gradually due to residual effect. Among the

chemicals dursban 20 EC was most destructive to lady bird beetle and spider. But in the observation of botanicals application the number of lady bird beetle reduced to a short extent. Among the botanicals karanja extracts was found most effective in reducing the number. Effect on yields also observed at the end of the experiment, by reducing test insect as yellow stem borer of rice by the application of botanical extracts and insecticides. The analysis showed significant level of variation in yield. Among the treatments dursban 20 EC treated plot yielded highest amount of rice. On the other hand botanical extract treated plots yielded lower amount of rice than that of the insecticides treated plots due to less effectiveness of botanicals than insecticides against yellow stem borer (YSB). Though the effectiveness of the botanicals was low than chemical insecticides, the botanicals conserve the ecosystem by not hampering the life of natural enemies of yellow stem borer (YSB). The results of the study on the effectiveness of different botanical extracts and insecticides for the controlling of yellow stem borer of rice, *S. incertulus* revealed that dursban 20 EC was the best to control yellow stem borer followed by convoy 25 EC, belt 24 WG and neem extract. Farmer may use neem based insecticide to produce rice which will ensure better yield and the conservation of beneficial insect in rice field ecosystem.

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