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Effect of Botanical Extract on Pest Control in Brinjal Field

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Abstract
An experiment was conducted to evaluate the effect of eight botanical extracts on pest control in brinjal field. Accordingly, water extracts of dried leaves of Khuksa (*Ficus hispida*), Chotra (*Lantana sp.*), Chirata (*Swietia chrata*), Neem (*Azadiracta indica*), Bael (Aegle marmelos), Holde-hurhuri (*Cleomp viscosa*) and Marigold (*Targetes erecta*) and seeds of Mahogany (*Swietenia mahagoni*) were prepared and sprayed in experimental brinjal field at Rajshahi University. Out of these botanicals, Khuksha leaves extract showed best performance against the pest attack compare to other extracts. Marigold leaf extract also showed good performance in the protection of brinjal plant from pest. The efficacy of Chotra, and Chirata leaf extracts was nearly same in brinjal plot against the pest attack. Neem leaf extracts showed moderate performance against pest. Mahogany seed extract showed lowest efficacy and hampered the normal plant growth and caused fruit rottening as well as reduced the yield of brinjal. Although Khuksha, Beal and Marigold leaf extracts were found effective against brinjal pests but a higher production was observed in the treatments of Neem and Chirata leaf extracts in experimental brinjal field.

Key Words: Brinjal, Production, Pest, Botanicals

Introduction

Botanical extracts are broad spectrum materials used in pest control and they are safe to apply, unique in action and can easily be processed. Locally available plant materials have been widely used in the past to protect the plants from damage caused by insects (Golob and Webly 1980). The main advantage of botanicals is that they are easily produced by farmers, cheaper and hazard free in comparison to chemical insecticides (Saxena *et al.* 1996). Botanical extracts have defensive compounds which make difficult or impossible for pests to consume the plants. Thus, in many countries efforts are being made to minimize the use of harmful chemical insecticides through the use of indigenous plant products and use of bio-degradable products to protect the brinjal plant (Khattach and Hameed 1986). The plant products include extracts of dried leaves, fruits and seeds.

The brinjal is of much importance in the warm areas of Far East, being grown extensively in India, Bangladesh, Pakistan, China and the Philippines. It is also popular in Egypt, France, Italy and United States. It is a versatile crop adapted to different agro-climatic regions and can be grown throughout the year (Cork *et al.* 2005).

In Bangladesh, brinjal or eggplant (*Solanum melongena)* is one of the most common and popular vegetable, grown round the year having two major growing seasons as summer and winter. It covers an area of 74,711 acres, which is about 15% of total vegetable areas of the country. Although the crop is grown throughout the country, it is intensively and commercially grown in Jessore, Rajshahi, Narsinghdi, Dhaka, Comilla and Bogra districts. At least fifteen insect pests and one mite pest are found to attack the eggplant. Among them, eggplant shoot and fruit borers, leafhoppers, ants, stem borer and epilachna beetles cause serious damage to the crop (BARI, 1995). One of the major factors of low yield of eggplant is pest attack.

Therefore, this study was conducted to find out the low-cost and effective plant-based pesticides to protect the brinjal field from pest attack.

Materials and Methods

Experimental Plot Preparation

This experiment was conducted at IES Research Field of Rajshahi University from October, 2011 to February, 2012. First the grasses and weeds of experimental plot were removed and the land ploughed properly and several holes were made every 150 inches interval. In each hole, required amount of cow-dung and chemical fertilizer was applied. About 40-days old brinjal seedlings (locally called kanta begun) were purchased from Katakhali bazar and planted in each hole. The experimental plot was irrigated with tap water when required.

Experimental Plot Design

Randomized Complete Block Design (RCBD) was followed for this experiment. Nine (9) treatments (three replications in each treatment) were applied in this experiment. Of them eight are different kinds of botanical treatments.

Preparation of Botanicals for Spray

Plant leaves of Khuksa (*Ficus hispida*), Chotra (*Lantana sp.*), Chirata (*Swietia chrata*), Neem (*Azadiracta indica*), Bael (Aegle marmelos), Holde-

hurhuri (*Cleomp viscosa*) and Marigold (*Targetes erecta*) and seeds of Mahogany (*Swietenia mahagoni*) were collected from Rajshahi region. Before grinding or cutting, the leaves and seeds were dried up in lab for 25-30 days. About 100 gm of leaf dusts or grinding seeds were dissolved in one litre of tap water in a plastic bucket and kept for three days. Then the botanical solution was filtered with plastic filter and preserved the filtrate in refrigerator until use.

Spray and Monitoring

The botanical solution was sprayed on brinjal experimental field twice a week with the help of a sprayer. The pest was monitored every day and damages were counted every 3-days in a week. The numbers of infested leaves were also recorded.

Statistical Analysis

The data was first input in Excel program and finally analyzed by ANOVA and DMRT using RCBD design.

Results and Discussion

The main compounds of plant extracts are essential oils (mono-terpenoids). These botanical compounds offer promising alternatives to chemical insecticides. These compounds may act as effective insecticides against vegetables pests (Cork *et al.* 2005; Muyinza *et al.* 2010), contact insecticides (Kim *et al*. 2004; Tapondjou *et al*. 2005), repellents (Hori, 2003) and antifeedants (Park *et al*. 2003).

In present study, effect of eight botanical extracts was tested in experimental brinjal field. Out of them Khuksha leaves extract (4.29±0.58) showed best performance against the pest attack on brinjal leaves compare to control (8.74±0.61). Marigold leaf extracts was also found very effective (4.67±0.04). The efficacy of Chotra (5.46±0.75) and Chirata (5.46±0.91) leaf extracts was nearly same in brinjal plot against the pest attack (Table 1).

Table 1. Effect of botanical extracts against pest attack on brinjal leaves

Sl. No	Treatments	No. of infested leaves
1.	Mahogany seed	6.58±0.52abc
2.	Khuksha leaves	4.29±0.58d
3.	Chotra leaves	5.46±0.75bcd
4.	Chirata leaves	5.46±0.91bcd
5.	Neem leaves	6.96±0.75ab
6.	Bael	5.04±0.90bcd
7.	Holde-hurhuri	7.00±0.66ab
8.	Marigold leaves	4.67±0.04cd
9.	Control	8.74±0.61a

Means followed by same letters do not differ significantly by DMRT ($P < 0.05$)

All the results mentioned above are highly significant ($P<0.05$). These results are in agreement with the findings of Cork *et al*. (2005). They noted that the extracts from neem extract, Cinnamon *(Cinnamomum cassia)*, Anise (*Illicium verum)* and Fennel (*Foeniculum vulgare)* as well as cinnamon oil, horseradish oil and mustard oil acted rapidly against pest and caused over 80% mortality to eggplant shoot and fruit borer.

During this study, leaf perforation was regularly monitored. Khuksha leaf extract (4.54±0.73) showed best performance against the leaves perforation caused by the pests. Marigold, Chotra and Bael leaves extracts provided moderate protection against the pests those responsible for making perforation on brinjal leaves (Table 2).

The efficacy of Khuksha extracts in the present study is substantially supported by the findings of Kumar and Devappa (2006), who reported that these extracts are effective in reducing fruit damage by *Leucinodes orbonalis* in brinjal.

Natural occurring predators that offer control of pests in brinjal fields are spiders, dragon fly and lady birds. In present experiment, the control treatment was severely effected by different kinds of insects and pests (mealy bugs, stem borer, red mite, brinjal fruit and shoot borer and eggplant lace bug) compare to the treatments applied with different kinds of botanicals. Only one insect (ants) was found the treatments of Khuksha and Neem (Table 3).

Botanical extract was found to have profound effect on the physiology of plants. Khuksha leaves extract showed highest plant length (33.17 cm) and leaves number (44.29±2.83) in comparison to control (29.74 cm). Chirata and Holde-hurhuri leaf extracts showed relatively lower plant growth (31.59 cm and 31.59 cm, respectively) than Khuksha extract. Effectiveness of Chotra and Bael leaf extracts on plant physiology was nearly same in brinjal field. Mahogany and Neem leaf extracts were found to phyto-toxic and showed negative plant growth of brinjal compare to control (Table 4).

Table 2. Efficacy of botanical extracts against perforation of leaves

Sl. No	Treatments	No. of perforation in leaves
1.	Mahogany seed	17.46±1.68b
2.	Khuksha leaves	4.54±0.73d
3.	Chotra leaves	8.88±1.01cd
4.	Chirata leaves	13.52±3.01bc
5.	Neem leaves	11.25±2.55bcd
6.	Bael leaves	8.63±2.63cd
7.	Holde-hurhuri	16.41±1.29b
8.	Marigold leaves	6.50±2.12cd
9.	Control	24.96±3.26a

Means followed by same letters do not differ significantly by DMRT (P <0.05)

Table 3. Pest observed in brinjal field

Sl. No	Treatments	Pest observed
1.	Mahogany seed	Epilachna beetles and ants
2.	Khuksha leaves	Ants
3.	Chotra leaves	Epilachna beetles
4.	Chirata leaves	Brinjal fruit and shoot borer
5.	Neem leaves	Ants
6.	Bael leaves	Grasshopper and leaf hopper
7.	Holde-hurhuri	Ants and stem borer
8.	Marigold leaves	Leaf hopper, grasshopper and stem borer
9.	Control	Mealy bugs, stem borer, red mite, brinjal fruit and shoot borer and eggplant lace bug

Table 4. Effect of botanical extract on brinjal plant growth

Sl. No	Treatments	Length of plants (cm)	Total number of leaves
1.	Mahogany seed	23.35±0.82d	19.42±1.82c
2.	Khuksha	33.17±0.74a	44.29±2.83a
3.	Chotra leaves	30.51±0.90bc	42.37±3.29a
4.	Chirata leaves	31.34±0.40ab	31.50±2.34b
5.	Neem leaves	28.65±0.45c	43.45±1.73a
6.	Bael leaves	30.75±0.48abc	29.25±2.67b
7.	Holde-hurhuri	31.59±1.49ab	40.38±0.99a
8.	Marigold leaves	32.15±0.42ab	30.79±1.01b
9.	Control	29.74±0.61bc	28.46±1.80b

Means followed by same letters do not differ significantly by DMRT (P <0.05)

Production of brinjal was found interesting in this study. Out of eight botanical extracts, Neem leaves extract showed highest net production (591.91±175.00 g) compare to control plant (440.11±41.96 g). The second highest production was observed in the treatment of Chirata leaf extract (574.55 g). Chotra extract also showed good performance in respect to brinjal production but Marigold, Khuksha and Bael leaf extracts showed poor production compare to control plant (Table 5). The treatment of Mahogany seed extract showed lowest level of brinjal production (59.32±59.32 g) due to high fruit loss (103.07±5.29 g), which is higher than the control treatment (77.08±2.64 g).

Table 5. Effect of botanical extracts on brinjal production

Sl. No	Treatments	Fruit loss (g)	Net production (g)
1.	Mehagony seed	103.07±5.29a	59.32±59.32c
2.	Khuksha leaves	25.09±3.60e	251.82±51.40bc
3.	Chotra leaves	30.13±4.58e	539.73±66.91a
4.	Chirata leaves	40.11±2.64d	574.55±26.67a
5.	Neem leaves	9.95±2.00f	591.91±175.00a
6.	Bael leaves	50.15±2.64c	187.10±35.72b
7.	Holde-hurhuri	44.23±2.00d	449.38±63.08ab
8.	Marigold leaves	26.11±1.73e	209.11±81.48bc
9.	Control	77.08±2.64b	440.11±41.96ab

Means followed by same letters do not differ significantly by DMRT (P <0.05)

Conclusions

Out of eight botanicals, Khuksha and Marigold leaves extract showed best performances, whereas Mahogany seed extract showed poor efficiency to protect the brinjal plant from pest attack. Mahogany seed extract hampered the normal plant growth and causes fruit rottening and high fruit loss. Although Khuksha, Bael and Marigold leaf extracts were found very effective against the brinjal pests but a higher production was found in the treatments of Neem and Chirata leaf extracts.

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