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THE EFFICACY OF BOTANICAL EXTRACT ON PEST CONTROL AND YIELD OF YARD-LONG BEAN FIELD

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ABSTRACT
An experiment was conducted to study the impact of nine different plant products on controlling viral infestation in Yard-long bean field. Fresh plant materials of Khoksha (Ficus hispida), Chotra (Lantana sp.), Chirata (Swietia chrata), Neem (Azadiracta indica), Beal (Abelmoschus esculentus), Halude-hurhuri (Cleomp viscosa) and Marigold (Targetes erecta), Mahogany seeds (Swietenia mahagoni) and Bishkatali were collected from different regions of Rajshahi. Randomized Complete Block Design was followed for the experiment. Ten treatments were applied and each treatment consists of three replications. This study revealed that extract prepared from Beal leaf was superior in terms of producing more yard-long bean leaves (78.57±0.600). Whereas few number of leaves attack (20.82±0.96) and highest yard-long bean production (77.51±31.85 gm) were found in the treatment of Beal leaf. Out of these botanicals, Beal leaf extract showed the best performance against the pest attack compares to other extracts. Neem leaf extract also showed good performance in the protection of yard long bean plant from pest. Halude hurhuri leaf extracts showed moderate performance against pest. Mahogany seed extract showed the lowest efficacy and hampered the normal average plant growth and low length (55.04±7.18 cm) plant as well as reduced the yield (4.72±4.7 gm) of yard-long bean. Although, Halude hurhuri, Chirata and Marigold leaf extracts were found effective against yard long bean pests but a higher production was observed in the treatments of Beal and Neem leaf extracts in an experimental yard-long bean field.

1. INTRODUCTION

Yard-long bean (*Vigna unguiculata* ssp. *sesquipedalis*) is gaining popularity as a tropical vegetable legume because of protein-rich pods, seeds, tender leaves, inflorescence, which are edible (AVRDC, 2006). Yard-long bean pods may grow to 10-20 inches long, but customers prefer them 10-12 inches

in length and pencil-size. Although both red seeded and black seeded yard-long bean exist, the black seeded pod is preferred for human consumption (Fery, 2002). The farmers always give priority to protect such a high-value crop from any damage caused by insects-pests and others. Especially environmental ones, lead the researchers to find new avenues of insect control in agriculture. Considering adverse effects of synthetic pesticides especially on non-target organisms caused a general perception that natural compounds are better products or Generally Regarded as Safe (GRAS) (Scott *et al.*, 2003). The indiscriminate use of chemical pesticides in storage has given rise to many well-known serious problems including genetic resistance of pest species, toxic residues in stored products, increasing costs of the application, environmental pollution, hazards from handling etc. (Khanam *et al*., 1990). There is an urgent need for safe but effective and biodegradable pesticides with no toxic effects on non-target organisms. This has created a worldwide interest in the development of alternative strategies including the search for new types of insecticides, re-evaluation and use of age-old traditional botanical pest control agents (Heyde *et al*., 1984). The use of plant extracts (botanical insecticides) to protect crops and stored products is as old as crop protection. Indeed, before the development and commercial success of synthetic pesticides beginning in the 1940s, botanical insecticides were significant weapons in the farmer' s arsenal against crop pests (Isman, 2008). Botanical insecticides tend to have broad-spectrum activity, are relatively specific in their mode of action, and easy to process and use. They also tend to be safe for higher animals and the environment (Anonymous, 1991). These unique beans grow on twining, delicate stems with a tenacious root system. Harvested seeds develop rusty patches quickly. Keep moist while in coolers, since dehydration in the coolers will lower quality and make them unmarketable. Aphids, particularly the black bean aphid *(Aphis fabae*), are drawn to the pods of this plant. Thrips tend to be a pest early in the season, but the plants will often out grow them, especially as the weather gets warmer and the plants grow faster (Harington, 1984). Botanical extracts are broad-spectrum materials used in pest control and they are safe to apply, unique in action and can quickly be processed. Locally available plant materials have been widely used in the past to protect damage caused by damage infestation (Golob and Webly 1980). The main advantage of botanicals is that they are easily produced by farmers and in small scale industries. They are cheaper and hazard free in comparison to chemical insecticides (Saxena *et al.*, 1996). They have defensive compounds which make difficult or impossible for pests to feed and would neither change the taste or smell of the product nor threaten the consumers or environment. Thus in many countries efforts are being made to minimize the use of harmful insecticides through the use of indigenous plant products and use of biodegradable products to protect the long bean from the attack of aphid, pod borer (Khattach and Hameed 1986). There is an urgent need for safe but effective and biodegradable pesticides with no toxic effects on non-target organisms. The plant products include extracts, dried leaves, pod, seeds and rhizomes etc. These plant products of the same species vary significantly in their efficacy. Ekesi (2000) evaluated the effect of volatiles. Therefore, this study was conducted to find out the low-cost and effective plant-based pesticides to protect the Yard-long bean field from pest attack.

2. MATERIALS AND METHODS

2.1 Experimental Plot Preparation

This experiment was conducted at IES Research Field of University of Rajshahi during the period of 10 March to 6 September 2018. First, the grasses and weeds of the experimental plot were removed, and the land ploughed properly, and several holes were made every 150 inches interval. In each hole, the required amount of cow-dung and chemical fertilizer was applied. The seed of yard long bean was

planted in each hole. The experimental plot was irrigated with tap water when required.

2.2 Experimental Plot Design

Randomized Complete Block Design (RCBD) was followed for this experiment. Ten (10) treatments (three replications in each treatment) were applied in this experiment.

2.3 Preparation of Botanicals for Spray

Plant leaves and seeds were collected from different places of Rajshahi region. Before grinding or cutting, the leaves and seeds were dried up in lab for 25-30 days. About 100 gm of leaf dust or grinding seeds were dissolved in one liter of tap water in a plastic bucket and kept these for three days. Then the botanical solution was filtered with synthetic filter and preserved the filtrate in the refrigerator until apply.

Table 1. Names of botanicals applied in Chili and Lady' s finger fields

Local name	Scientific Name	Used Plant Parts (Bio-pesticides)
1. Control	-	-
2. Mahogany seed	Swietenia mahagoni	Seeds
3. Khoksha leaves	Ficus hispida	Leaves
4. Chotra leaves	Lantana sp	Leaves
5. Chirata leaves	Swietia chrata	Leaves
6. Neem leaves	Azadiracta indica	Leaves
7. Beal leaves	Abelmoschus limonica	Leaves
8. Halude hurhuri	Cleomp viscosa	Whole plants
9. Marigold leaves	Targetes erecta	Leaves
10. Bishkatali	Polygonum hydropiper	Leaves

2.4 Spray and Monitoring

The botanical solution was sprayed on yard long bean experimental field twice in 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.

2.5 Statistical Analysis

The observed values were statistically analyzed by randomized complete block design (RCBD). Mean values were adjusted by one-way ANOVA and the significant level was tested by Duncan' s Multiple Range Test (Duncan, 1951).

3. RESULTS AND DISCUSSIONS

3.1 Effect of botanical pesticides on pest control in yard-long bean leaves

In this study, we found less number of insect attacks on yard-long bean leaves in treatment of Mahogany (15.11±0.59), Beal leaf (20.82±0.96) and Chirata (22.67±3.21bcd), whereas a high number of insect attack was found in the Neem leaf (41.78±5.49), marigold leaf (38.33±4.77) and Halude hurhuri treatment (35.89±2.12) and control (75.83±16.56) Leaves perforation in yard-long bean field was regularly monitored. Water extract of treatment of Beal leaf (15.00±2.08c) and Chirata (17.56±1.85c) showed the best performance against leaves perforation caused by pests. Water extract of Halude hurhuri (18.67±2.17c) and Bishkatali (18.44±2.99c) was also found very effective against the perforation compare to control (40.00±3.10a). Stem attacked by aphids was regularly monitored and the result was found very interesting that all the botanical extracts attract the aphids except the control. The result found negative in the case of aphids because all extract using plants were affected

by aphids (Table 2). Some researcher found that the use of botanicals such as Neem and other bio-pesticides to control insect pests of vegetables are gaining much attention (Obeng-Ofori et al., 2002; Coulibaly et al., 2007). These findings are by the report of Bindu et al. (2005) who concluded that Neem seed kernel 5% showed a repellent effect against jassids in okra crop.

Table 2. Effect of botanical extracts against pest attack on Yard-long bean leaves

Treatment	Average No. of Leaves attacked	Average No. of leaf perforation	Stem Attacked by Aphids
1. Control	75.83±16.56a	40.00±3.10a	6.30±0.58a
2. Mahogany seed	15.11±0.59d	24.33±2.40bc	1.33±0.33cd
3. Khoksha leaves	28.56±1.57bcd	26.15±2.00bc	5±0.58ab
4. Chotra leaves	23.44±2.63bcd	30.44±6.12ab	3±0.58bc
5. Chirata leaves	22.67±3.21bcd	17.56±1.85c	2.66±0.33c
6. Neem leaves	41.78±5.49b	22.56±2.19bc	3±0.58bc
7. Beal leaves	20.82±0.96cd	15.00±2.08c	2±0.58c
8. Halude hurhuri	35.89±2.12bc	18.67±2.17c	3.66±0.33b
9. Marigold leaves	38.33±4.77bc	24.56±6.49bc	3.66±0.88b
10. Bishkatali	31.33±3.42bcd	18.44±2.99c	3.66±0.67b

3.2 Effect of botanical extracts on yard-long bean plant growth

The highest number of leaves was found in Beal leaf treatment (78.57±0.600a) while the least amount of leaves was in Mahogany treatment (17.166±0.970e) (Table 3). Fuchs (1970) reported that nutrients from mineral fertilizers and bio-pesticides enhanced the establishment of crops while those from the mineralization of organic matter promoted yield.

The tallest yard long bean plant was observed in the treatment of Halude hurhuri (160.67±6.06 cm) Neem (129.66±10.17cm) and Beal leaf (125.33±14.57 cm) while the shortest plant was in the treatment of Mahogany (55.04±7.18 cm). The vigorous growth in Yard long bean was experienced during the growing period as evidenced in the vine length and number of leaves produced per plant (Table 3). Nutrients from mineral fertilizers and bio-pesticides enhanced the establishment of crops while those from the mineralization of organic matter promoted yield. This result also supported by Fiscian (1999) and AVRDC (2003).

Table 3. Effect of botanical extracts on yard long bean plant

Treatment	Total Number of leaves	Length of plant (cm)
1. Control	75.83±16.56ab	118.00±7.70bcd
2. Mahogany seed	17.166±0.970e	55.04±7.18e
3. Khoksha leaves	54.3667±0.523c	118.11±8.62bcd
4. Chotra leaves	54.40±0.360c	125.34±17.85bc
5. Chirata leaves	55.66±0.523c	89.11±11.08cde
6. Neem leaves	78.17±0.674a	129.66±10.17ab
7. Beal leaves	78.57±0.600a	125.33±14.57bc
8. Halude hurhuri	60.47±0.480b	160.67±6.06a
9. Marigold leaves	43.07±2.596d	108.34±12.57bcd
10. Bishkatali	44.77±0.677d	86.89±9.14de

3.3 Effect of botanical pesticides on pest control

Pest attack was monitored regularly in Yardlong bean field. We observed that the treatment of control was affected by various kinds of pests and insects epilachna beetle, red beetle, black ants and grasshoppers compare to less of number insect attacks in botanical pesticides applied treatments. During this study, all but only one insect (Aphids) was not found in control (Table 4).

Table 4. The following insects and pests were observed in the experimental field

Sl. No	Treatments	Pest observed
1	Control	Epilachna beetles, Ants, Aphids
2	Mahogany seed	Aphids
3	Khoksha leaves	Epilachna beetles, Ants, Aphids
4	Chotra leaves	Ants, Aphids
5	Chirata leaves	Aphids, Ants
6	Neem leaves	Aphids
7	Beal leaves	Aphids
8	Halude hurhuri	Ants, Pod borer, Aphids
9	Marigold leaves	Grasshopper, Aphids
10	Bishkatali	Aphids, bettles

3.4 Effect of botanical extracts on fruit of yard-long bean

The Beal leaf extract (77.51±31.85a) using plant showed the highest production of yard-long bean in comparison to the control plant. Neem leaf and Halude hurhuri leaf extract showed relatively less production than Beal leaves extract. Chirata leaf (33.28±12.97ab) extract showed better performance on total production per plant in comparison to the control plant (25.85±14.79ab). Whereas Marigold (19.69±8.66ab), Khoksha (18.15±12.73ab), Bishkatali (18.67±2.17c), Chotra (11.34±3.84b) leaves showed total negative production than control plant. Mahogany seed extract (4.72±4.72b) showed poor production compare to control plant (Table 5). The above results supported by the findings of Neem seed crude extract (2.5%) in increasing yield in the present study agreed with the finding of Mudathir and Basedow (2004), Pun et al. (2005) and Adilakshmi et al. (2007). Similar results from studies in Asia and parts of Africa support to these findings (Titiloye, 1982; Costa et al., 1991; FAO, 2003).

Table 5. Effect of botanical extract on production of Yard-long bean (g)

Treatment	Production of Yard-long bean (g)
1. Control	25.85±14.79ab
2. Mahogany seed	4.72±4.72b
3. Khoksha leaves	18.15±12.73ab
4. Chotra leaves	11.34±3.84b
5. Chirata leaves	33.28±12.97ab
6. Neem leaves	66.60±37.15ab
7. Beal leaves	77.51±31.85a
8. Halude hurhuri	45.22±19.29ab
9. Marigold leaves	19.69±8.66ab
10. Bishkatali	18.67±2.17c

4. CONCLUSIONS

Out of nine botanicals, Beal and Neem leave extract showed the best performances to protect the yard-long bean plant from pest attack and yield of Yard-long bean, whereas Mahogany seed extract showed poor efficiency. Mahogany seed extract hampered the normal plant growth, low length of plant and caused poor production. Although Halude hurhuri, Chirata and Marigold leaf extracts were found very effective against the yard-long bean pests a higher production was found in the treatments of Beal and Neem leaf extracts.

Conflict of interests

The authors declare no conflict of interest.

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