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PRACTICE OF BOTANICAL PESTICIDES FOR SUSTAINABLE AND SAFE VEGETABLES PRODUCTION IN BANGLADESH

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ABSTRACT

The study consisted of three types of botanical such as neem oil, mahagoni seeds and pyrethrum flower including one chemical, namely malathion, were used against red pumpkin beetle in the period of April 2017 to October 2018 at Polder 32 in Dacope upazila of the Khulna district. The study stated that the neem oil ensured the minimum % leaf infestation, while control treatment gave the maximum percentage in cucumber. Among the botanical products, neem oil achieved 1.33 and 1.63 times better performance than that of mahogoni seeds and pyrethrum flower, respectively in respect of leaf infestation. The study also examined the fruit weight/plant ranged from 0.25-4.08 kg/plant, which was detected as significant due to the effect of botanicals and malathion. Here Neem oil gave the best as well as the highest fruit yield with the value of 4.08 kg/plant, which was noted as the 1.15, 1.22, 1.07 and 16.50 times higher yield/plant than that of mahogoni seeds and pyrethrum flower, malathion and the control, respectively. Although, the most commonly used method for controlling red pumpkin beetle in Bangladesh is the use of insecticides, but only botanical extracts ensured fully protected cucumber for human consumption, both in fresh and cooked dishes.
Key words: Botanical pesticide, malathion, red pumpkin beetle, cucumber.

Introduction

Agriculture in Bangladesh has changed dramatically, especially since the end of the independent war. As a result of these changes, farmers were able to produce the majority of crops with fewer workers in Bangladesh. Although these changes have many positive effects and have reduced many risks in agriculture, there have also been considerably top depletion of soil, ground and surface water pollution, constant neglect of living and working conditions for farm work, increasing production costs and the disintegration of economic and social conditions in rural communities (ASR, 2006). Over the past three decades, the random use of chemical pesticides in agriculture has led to serious health and environmental problems in many developing countries (World Resources, 1999). The World Health Organization (WHO) and the United Nations Environment Program estimate pesticide poisoning rates of 2-3 per minute, with around 20,000 employees dying each year from exposure, the majority in developing countries (WHO, 1990; Kishi *et al*., 1995; Rosenstock *et al*., 1991). Prolonged exposure to pesticides can lead to cardiopulmonary disorders, neurological and hematologic disorders and skin diseases (Davies *et al*., 1982; Smith *et al*., 1988). From an environmental point of view, chemically contaminated field drainage has contaminated surface and groundwater, damaged fisheries, destroyed freshwater ecosystems and created growing "dead zones" in ocean areas near the mouths of rivers that drain agricultural areas (Pimental *et al*., 1992; Tardiff, 1992). Indiscriminate and excessive use of pesticides posses excessive residues on the fruits affect consumer health and the environment, pesticide resistance, poisoning, danger to non-target organisms (Guan-Soon, 1990). Residue problems have therefore become quite alarming, due to the continuous and uncontrolled use of very persistent pesticides in agricultural and public health programs. Now the sustainable agriculture movement is receiving more and more support and acceptance within mainstream of agriculture. Not only does sustainable agriculture address many environmental and social problems, it also offers innovative and economically viable opportunities for growers, workers, consumers, policy makers and many others throughout the food system with regard to a sympathetic environment (Faroque *et al*., 2011).

We know that Bangladesh is an overpopulated country. Food shortages and malnutrition have therefore become general problems in our country. The problem of existing acute malnutrition and food shortages can be overcome by significantly producing more vegetables, which will ultimately lead to the building of a healthy nation (Zaman, 2010). The losses caused by insects are a serious problem for higher vegetable production. In previous studies no fewer than seven dozens of insect pests have been registered on nine types of vegetables and 170 diseases on 27 vegetable crops. The most important insect pests and diseases cause 30-40% yield losses for vegetable crops (Karim, 2004). The insects lose the cucumber to a certain extent. Here, red pumpkin beetle is one of the most important destructive insects (Rahman *et al*., 2013) on various cucurbit crops and preferably reported from cucumber. The farmers always give priority to protecting such a high-quality vegetable crop against any form of damage caused by insects and vermin. However, many methods have been used to combat the beetle, but synthetic insecticides still play an important role in the last fifty years. Botanicals are a promising source of pest control agents (Rahman *et al*., 2007). The large-scale commercial use of plant extracts as insecticides began in the 1850s. The attention for the non-effect of chemical insecticides has now shifted to non-chemical methods for pest control (Bhaga and Kulkarni, 2012). Alternatively, the use of bio-pesticides (botanical and microbial) is widely promoted as safe and environmentally friendly means to combat the pest and diseases also contain the harmful effects of chemical pesticides. Many of these bio-pesticides are within the reach of farmers in terms of costs and many of these formulations can also be prepared by farmers.

Eco-friendly pest management, such as the use of botanical extracts, offers a great opportunity to save beneficial soil microorganisms. Most botanical extracts are also cost effective and available to farmers on time. As a result, botanical pesticides are becoming popular day after day. Now these are used against many insects. However, the use of botanical extracts against insect control is a recent approach to insect control and has attracted special attention from the Entomologist around the world. In Bangladesh only a few attempts have been made to evaluate botanical extracts against insect pests (Rahman *et al*., 2011). It would help to prevent environmental pollution caused by chemicals and thus become the most rewarding in our existing socio-economic conditions and environmental threat. Given the above circumstances, a piece of research has been conducted to find out the insecticidal efficacy of botanical products for combating cucumber pests in Bangladesh.

Materials and Methods

The study was conducted from April 2017 to October 2018 at Polder 32 in Dacope upazila of the Khulna district. Three botanicals (neem oil, mahagoni seeds and pyrethrum flower) used for the study were collected from the embankment side of the polder area to control the insect infestation of cucumber. The selected botanicals together with one chemical (malathion) and control treatment were used on cucumber following the Randomized Complete Block Design (RCBD) with three no. of replications. The cucumber crop was grown according to the standard cultivation method. The plants of the experimental plots were sprayed twice a week with three botanical extracts (extracts @ 10% with 0.5% detergent) and malathion (concentration of 0.1%) using a sprayer. After the application of botanical and chemical substances, an attack of cucumber leaves was observed. In the end, growth and fruit weight of cucumber were measured. The observed values were statistically analyzed with RCBD. Mean values were adjusted in one way ANOVA and the significant level was tested with the Duncan Multiple Range Test (Duncan, 1951).

Results and Discussion

The study meticulously examined the plant height and no. of leaves/plant of cucumber, which differed considerably between botanicals and malathion (Table 1). Neem oil showed the highest plant height (221.91 cm) and none more no. of leaves/plant (65.86 no.) without statistical difference with malathion (214.91 cm plant height and 66.32 no. of leaves/plant, respectively). Control treatment gave the shortest plant (199.51 cm) as well as less no. of leaves/plant (58.71 no.). The mahogoni seeds and pyrethrum flower ranked in the 3rd and 4th highest positions among the studied botanicals and malathion including the control

ones, in respect of plant height and no. of leaves/plant of cucumber (Table 1). No. of fruits/plant significantly affected by botanicals and malathion (Table 1), where neem oil produced the highest no. of fruits per plant (23.44 nos.) having no statistical difference with malathion. Here the control treatment delivers the lowest number of fruits/plant. Both mahogoni seeds and pyrethrum flower produced more fruits/plant than that of control but less fruits/plant than that of malathion and neem oil. The fruit/plant produced ranged from 14.42 to 23.44 in the current study produced by the use of botanicals and malathion (Table 1). The study also examined the significant no. of beetles/plant as affected by botanicals and malathion. Here, neem oil and malathion provided the minimum number of bettels/plants without a statistical difference with mahogoni seeds and pyrethrum flower. The highest no. of beetles/plant in cucumber was observed in control treatment (Table 1).

Table 1. Effect of botanicals and Malathion on growth and yield characteristics including the presence of beetle in cucumber field

Treatments	Plant length (cm)	No. of leaves/plant	No. of fruits/plant	No. of beetles/plant
Control	199.51c	58.71c	14.42c	5.15a
Malathion 50 Ec	214.91a	66.32a	22.22a	1.30c
Neem oil	211.19a	65.86a	23.44a	1.26c
Mahagoni seeds	190.53b	58.50ab	18.30b	1.80bc
Pyrethrum flower	185.37b	55.21b	16.99b	2.12b
Level of significance	**	**	**	**
CV (%)	2.19	9.76	8.51	2.76

* Means in a column followed by the same letter are not significantly different at (P<0.01) by DMRT.

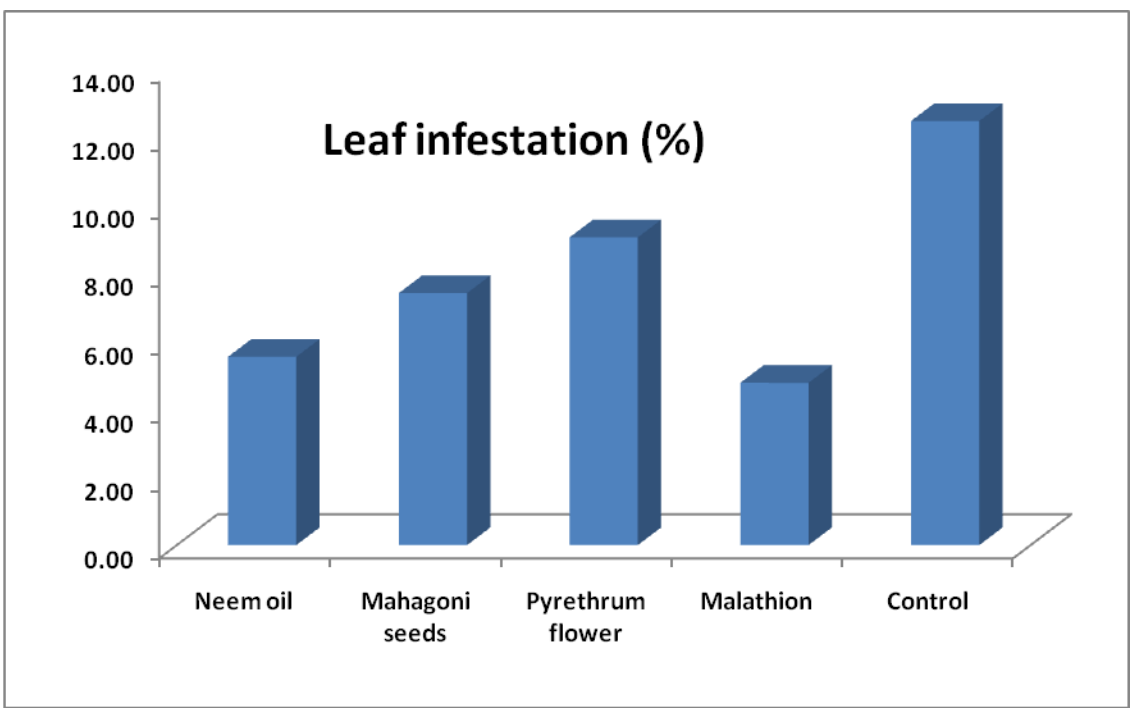

Fig. 1 Effect of plant extracts and malathion on % leaf infestation

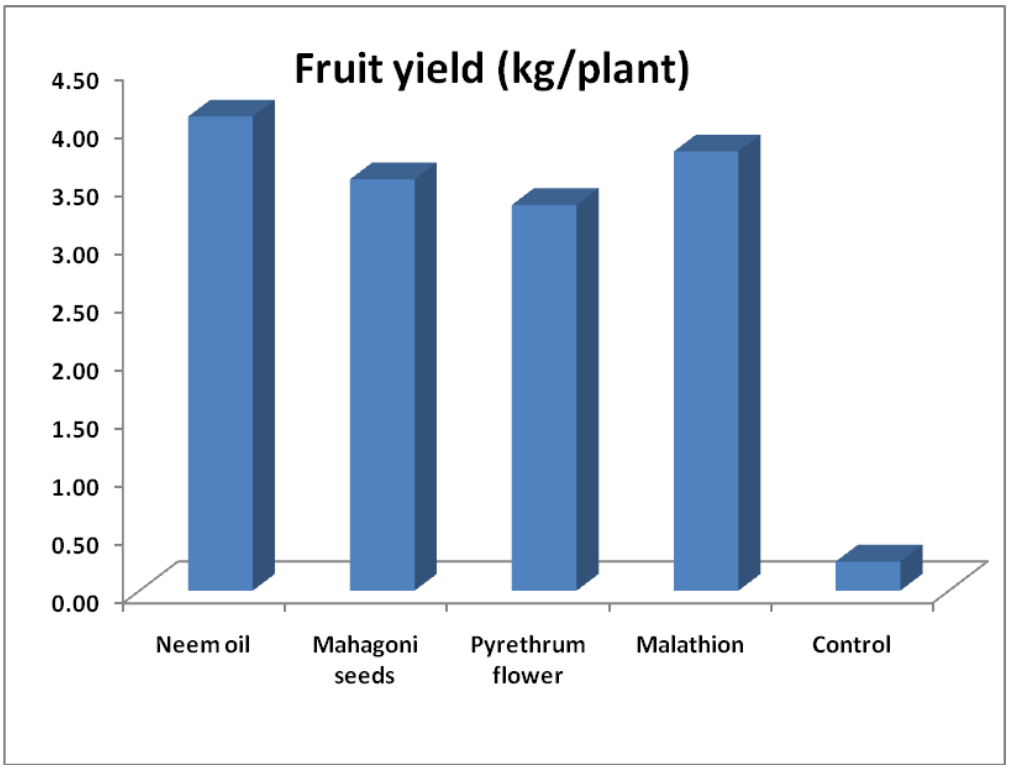

Fig. 2 Effect of plant extracts and malathion on cucumber yield

The botanical products studied together with malathion retained the excellent and significant effect on the % leaf infestation on cucumber. The neem oil ensured the minimum% leaf infestation (Fig. 1), while control treatment gave the maximum percentage in cucumber. Among the botanical products, neem oil achieved 1.33 and 1.63 times better performance than that of mahogoni seeds and pyrethrum flower, respectively. In such cases, neem oil showed 1.20 times (approximately) higher performance than the chemical insecticide (malathion). The study also examined the fruit weight/plant ranged from 0.25-4.08 kg/plant (Fig. 2), which was detected as significant due to the effect of botanicals and malathion. Here Neem oil gave the best as well as the highest fruit yield as the value 4.08 kg/plant, which was noted as the 1.15, 1.22, 1.07 and 16.50 times higher yield/plant than that of mahogoni seeds, pyrethrum flower, malathion and the control, respectively (Fig. 2).

There are many insect pests of cucurbits in Bangladesh, among which red pumpkin beetle is one of the most important enemies for the production of cucurbit with a yield loss of 30-100% (Dillon *et al*., 2005). It is polyphagous and attacks more than 81 plant species, including pumpkin, cucumber, bottle guard, sweet guard, bitter gourd, snake gourd, wax gourd, watermelon, etc. (Doharey, 1983). In the study, the effectiveness of botanicals and malathion showed the significant effect on plant height, no. of leaves/plant, no. of fruits/plant and fruit weight (kg/plant). Plant extract showed minimal damage, which also confirms the results of Datta and Saxena (2001). The studied botanical agents are also considered to be the effective in terms of % leaf infestation, which was lower in malathion but there was no statistical difference with neem oil. On the other hand, control treatment always showed more beetles/plant as well as a higher leaf infestation. Although, the most commonly used method for controlling red pumpkin beetle in Bangladesh is the use of insecticides (Karim, 1992), but the botanical extracts ensured the fully protected cucumber for human consumption, both in fresh and cooked dishes. The research can therefore be considered as part of sustainable agriculture, which also confirmed safe and secured vegetable production in Bangladesh.

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