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APPLICATION OF PLANT EXTRACT FOR THE MANAGEMENT OF EPILACHNA BEETLE ON BITTER GOURD

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ABSTRACT

Plant extracts were used to assess their insecticidal activities on Epilachna beetle on bitter gourd. The experiment consisted of six different treatments 1.Control 2. Malathion 57EC 2ml/1L of water; 3.Tephrosia leaf extract 20 g fresh leaf/100 ml of water; 4. Neem oil sprayed at 3 ml oil/1 L of water 5. Neem leaf extract at 20 g fresh leaf/100ml of water; 6. Bishkatali leaf extracts 20 g fresh leaf/100ml of water and there were three replications. The botanical extracts showed varying effect on Epilachna beetle population. Among the plant extract *Tephrosia* leaf extract showed higher activity against the Epilachna beetle. On the other hand, the highest insect infestation was observed in untreated control and Bishkatali and neem oil was 2nd and 3rd in the rank. Hence, it may be suggested that Tephrosia leaf extract, Bishkathali and Neem would be treated as a ecofriendly pest control method.

Keywords: *Momordica charantia*, *Ephilachna sp*, pesticides

Introduction

Bitter gourd (*Momordica charantia*) is a popular summer vegetable in Bangladesh of the family Cucurbitaceae. It is probably originated from the Indian sub-continent (Deshmukh et al. 2012). It has nutritional and medicinal value since it contains important elements such as Vitamin C 33.00 mg, Calcium 9 mg, Magnesium 16 mg, Potassium 319 mg and Phosphorus 36 mg. (Tayde and Simon 2013.). Bitter gourd is seriously affected by at least two major pests, Epilachna beetle (*Ephilachna sp*) and Cucurbit fruit fly (*Daucus cucurbitae*). Epilachna beetle can be easily identified by its 14 spots or 28 spots on its dorsal body. Both adult beetles and grubs feeds voraciously by scrapping green matter from leaf surface resulting leaves becoming dry (Imura and-Ninomiya 1978). The growth and development of the plants are greatly hampered and the yield is markedly reduced by the attack of this beetle (Alam 1969). The grubs mainly attack to the lower surface of the leaves and adults usually feed on the upper surface of the leaves (Prodhan *et al*. 1990). The third and the fourth instar grubs are most destructive and voracious. Rajgopal and Trivedi (1989) reported that epilachna beetle may damage upto 80% of plant; however, percentage seasonal damage may vary on environmental conditions. Bitter gourd growers usually use different kinds of insecticides for controlling epilachna beetle and often apply pesticides at doses higher than recommended (Sharma and Choudhury 2018). This random application of pesticides cause serious hazardous impacts on human health, target plants, food and other living things as well as to the ecosystem. In the present situation, farmers do not have many effective alternatives to avoid the use of synthetic pesticides.

Botanicals for pest management help to reduce the dependence on synthetic pesticides and ecological deterioration. Botanicals serve as insecticides, insect repellents and insect antifeedants (Islam et al., 2011). The use of homemade botanical pesticides such as extracts of neem (*Azadirachta indica*), bishkatali (*Polygonum hydropiper*), and tephrosia (*Tephrosia vogelii)*, which are reported to have pest control properties. The neem tree locally available in parts of Bangladesh, is well known for its insecticidal properties contained primarily in the seeds but also in the leaves of the plant (Schmutterer 1990). Neem oil is being produced and sold locally by the Bangladesh Neem Foundation (BNF) in Dhaka. Previous work showed that neem compounds are sustainable larvicides because they do not pollute the environment, or create resistant populations (Okumu *et al*. 2007). Neem oil was shown to cause larval mortality and reduced feeding in epilachna beetle adults and larvae and has been recommended for use in protecting bitter gourd plants against damage (Haque *et al*. 1996). *Tephrosia vogellii*, a plant originating in Africa has also been documented to

contain insecticidal properties effective in controlling many kinds of insects (Elwel and Maas 1995, Meitzner and Price 1996). Bishkatali is a weedy plant growing throughout Bangladesh, the leaves of which farmers apply to the soil for cutworm control. If the farmers could effectively control pests by making their own pesticide extracts from local plants, this would reduce production costs.

In this observation, water extracts of neem leaf, neem oil, bishkatali leaf and tephrosia leaf were sprayed in order to observe the effectiveness of these treatments. The objective of this trial is to compare the effects of these sprays on bitter gourd pest infestation, compared with a chemical pesticide and untreated control.

Materials and Methods

The research trial was conducted under RCB design with three replications and six treatments. These treatments consisted of Malathion 57EC @ 2ml/L water, neem oil sprayed @ 3ml oil/L water, neem leaf extract @ 20g fresh leaf/100ml water, bishkatali leaf extract @ 20g fresh leaf/100 ml water, tephrosia leaf extract @ 20g fresh leaf/100ml water and control. On the spray dates neem, tephrosia and bishkatali leaf extracts were prepared by grinding 200g of leaves, mixing with water and filtering through filter paper. A small amount of soap powder was added to the solution. Before spraying 50ml of extract was added to 2 liter of water in spray machine for calibration of botanicals extracts. The plant extracts and Malathion 57EC were sprayed at 15 day intervals at rate on label. The experimental plot 3m × 3m was prepared and between plot spacing 0.5m. Seedlings were grown in a seed bed to raise seedling and transferred into the main field when they were 4-5 leaves stage. In the field, 150cm distance for plant to plant and 150cm distance for row to row was maintained. A border of stem amaranth was planted around each plot about two weeks before bitter gourd was planted.

Data Collection: In each plot, all the epilachna beetle larvae and pupae were counted from bottom leaf surfaces from each plot (1 square meter). At the fruiting stage all the fruits were harvested three to four times from each plot. Insect observations were recorded at 45, 60, 75 and 90 days after transplanting (DAT). Sampling was done by observing larvae and pupae under the leaf surface after spraying. The number of healthy and number of infested fruits was recorded at every harvest.

Statistical analysis: The data were statistically analyzed with the help of SPSS computerized software (version 16). The treatment means were compared using Duncan Multiple Range Test at 5% level.

Results and Discussion

Natural pesticides for protecting crops from insect pests has implied greater important to build up awareness of harmful effects of synthetic pesticides (Jeyasankar *et al.* 2013). In nature many plants have high content of phenols, alkaloids, flavanoids, terpenes, quinone, coumarin etc., which play a defensive role against particularly agriculture insect pests. Identifying sources with useful biological activity is only the starting point in the long process of development of a botanical pest management product. In this study, different plant which is locally available in Bangladesh were collected and screened insecticidal activity against epilachna beetle.

Number of epilachna beetle larvae was counted from each plot (one square meter). The result showed that the highest number of larvae was found in control treatment and lowest was found in Malathion 57EC at 45 and 60 days after transplanting. But at 75 and 90 day observation showed that different plant extract specially tephrosia performed better than chemical insecticides Malathion 57EC (Table 1). Other leaf extract also gave satisfactory result. Earlier studies have also reported that derivatives of plant repel insect pests of cucurbits (Budhathoki *et al*. 1993). Plant extracts contain botanical insecticides or phytochemicals that could be used to repel, discourage feeding, or limit reproduction and survival of various insect pest species (Rajagopal and Trivedi 1989)

Similarly the average number of pupae of Epilachna beetle was counted from each plot (one square meter) at 45, 60, 75 and 90 DAT where it showed significant differences among all treatments. The highest number of pupae of epilachna beetle was found in the control treatment in every date of sampling. From all treatment it has been revealed that the Tephrosia leaf extract performance better than control to inhibit the pupae of epilachna beetle (Table 2).

There were statistically significant differences both the number of good fruit and infested fruit of the six treatments. Tephrosia plant extract treated plots on average gave much higher number of good fruit and lower number of infested fruit compared to control. Both the number of good fruits and infested fruits of this trial

Table1. Effect of plant extracts treatments on the number of Epilachna beetle larvae counted (one square meter) at different days after transplanting (DAT)

Treatment	45 DAT	60 DAT	75 DAT	90 DAT
Control	12.33 a	13.33 a	12.67 a	21.33
Malathion	2.67 d	1.67 b	3.33 bc	12.00
Tephrosia	4.33 cd	3.00 b	2.00 c	6.67
Neem oil	8.00 b	6.33 b	4.00 bc	14.00
Neem leaf	8.67 b	5.00 b	6.33 b	11.00
Bishkathali leaf	6.33 bc	5.00 b	3.33 bc	10.00

Values are mean of three replications. Means followed by the same letter are not significantly different at the 5% level by DMRT

Table 2. Effect of plant extracts treatments on the number of Epilachna beetle Pupae counted (one square meter) at different days after transplanting (DAT)

Treatment	45 DAT	60 DAT	75 DAT	90 DAT
Control	8.00 a	9.67 a	11.33 a	10.33 a
Malathion	1.67 b	1.67 b	1.67 c	5.33 ab
Tephrosia	0.67 b	0.67 b	1.00 c	3.33 b
Neem oil	3.00 b	5.67 ab	2.67 bc	4.67 b
Neem leaf	4.00 b	3.67 b	5.33 b	7.00 ab
Bishkathali leaf	3.33 b	5.0ab	2.33 bc	5.33 ab

Values are mean of three replications.Means followed by the same letter are not significantly different at the 5% level by DMRT

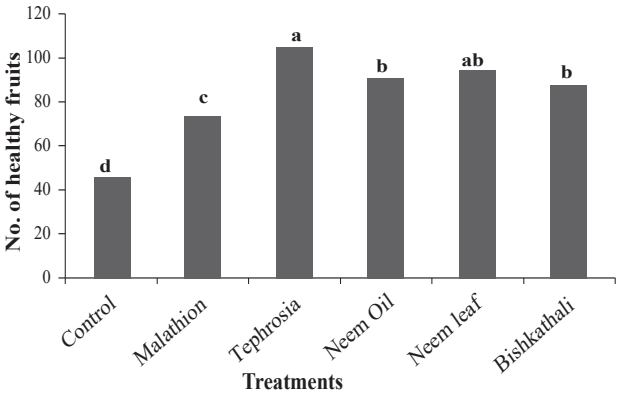

Figure 1. Effect of different plant extract treatments on the number of healthy fruits of bitter gourd.

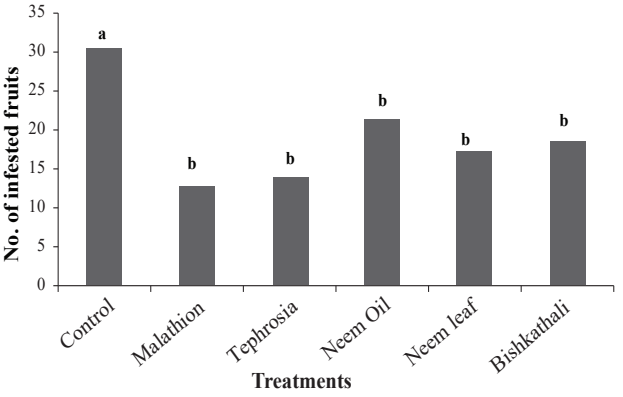

Figure 2. Effect of different plant extract treatments on the number infestested fruits of bitter gourd.

showed significant differences among the treatments (Figure 1 and Figure 2).

The Tephrosia leaf extract did better among than Malathion 57EC treatment. Similar works have already reported insecticidal activity of many plants and their compounds against different groups of insects (Rajam 1991)

Lower number of set fruit in chemical insecticide Malathion treated plot might be due to chemical sensitivity in flowers resulting in poor fruit set and less numbers of crop harvest (Sapokota 2013). Neupane (2000) also concluded that by using chemical pesticide that can be increased cost of production. Similarly, Dhillon *et al.* (2005) also pointed out difficulties to control this pest with insecticides.

In conclusion, tephrosia showed higher insecticidal activities against epilachna beetle. Neem oil, neem leaf, bishkathali leaf also gave better performance than control. Hence, it may be suggested that the leaves extracts of tephrosia and bishkathali could be used for controlling the epilachna beetle on bitter gourd pest.

References

Alam MZ. 1969. Insect pests of vegetables and their control in East Pakistan. Pp146.

Budhathoki K, Gurung DB and Lohar DP. 1993. Vegetable crops: Indigenous knowledge and technology in the western hills of Nepal. In Seminar paper. Lumle Agricultural Reaserch Centre, Kaski, Nepal.

Deshmukh PS, Chougale AK, Shahasane SS, Desai SS and Gaikwad SG. 2012. Studies on biology of Hadda beetle, *Epilachna vigintioctopunctata* (Coleptera, Coccinillidae): a serious pest of wild better gourd, Momordicadioica. Trends in Life Sciences, *1*: 46-48.

Dhillon MK, Naresh JS, Singh R and Sharma NK. 2005. Influence of physico-chemical traits of bitter gourd, *Momordica charantia* L. on larval density and resistance to melon fruit fly, *Bactrocera cucurbitae* (Coquillett). Journal of Applied Entomology, *129*: 393-399.

Elwell H and Maas A. 1995. Natural pest and disease control, Natural Farming Network.

Haque MA, Parvin N and Ahmed KS. 1996. Effect on neem oil on the food consumption and survival of *Epilachna duodecastigma* (Wied.). Bangladesh Journal of Entomology, *6*: 1-5.

Imura O and Ninomiya S. 1978. Quantitative measurement of leaf area consumption by *Epilachna vigintioctopunctata* (Fabricius) (Coleoptera: Coccinellidae) using image processing. Applied Entomology and Zoology, *33*: 491-495.

Islam K, Islam MS and Ferdousi Z. 2011. Control of *Epilachna vigintioctopuntata* Fab. (Coleoptera: Coccinellidae) using some indigenous plant extracts. Journal of Life and Earth Science, *6*: 75-80.

Jeyasankar A, Premalatha S and Elumalai K. 2014. Antifeedant and insecticidal activities of selected plant extracts against Epilachna beetle, *Henosepilachna vigintioctopunctata* (Coleoptera: Coccinellidae). Advances in Entomology, *2*: 14.

Meitzner LS and Price ML.1996. Amaranth to Zai Holes: Ideas for Growing Food under Difficult Conditions. Educational Concerns for Hunger Organization, Ft. Myers Florida. 404.

Neupane FP. 2000. Integrated management of vegetable insects. CEAPRED, Bakhundol, Lalitpur, Nepal. p. 172.

Okumu FO, Knols BG and Fillinger U. 2007. Larvicidal effects of a neem (Azadirachta indica) oil formulation on the malaria vector *Anopheles gambiae*. Malaria Journal, *6*: 63.

Prodhan S, Jotwani MG and Prakash S. 1990. Comparative toxicity of insecticides to the grub and adult of *Epilachna vigintioctopunctata* Fab. (Coleoptera: Coccinellidae). Indian Journal of Entomology, *24*: 223.

Rajagopal D and Trivedi TP. 1989. Status, biology and management of epilachna beetle, *Epilachna vigintioctopunctata* Fab. (Coleoptera: Coccinellidae) on potato in India. Tropical Pest Management, *35*: 410-413.

Rajam MV. 1991. Insecticidal activity of inhibitors of polyamine synthesis on *Spodoptera litura* F. larvae. Indian Journal of Experimental Biology, *29*: 881-882.

Sharma D and Choudhury PP. 2018. Pesticide residues and their management in vegetables.

Schmutterer H. 1990. Properties and potential of natural pesticides from the neem tree, *Azadirachta indica*. Annual Review of Entomology, *35*: 271-297.

Tayde AR and Simon SOBITA. 2013. Studies on biology and morphometris of Hadda beetle, *Epilachna vigintioctopunctata* (Coleoptera: Coccinellidae) a serious pest of bitter gourd, *Momordica charantia*, in eastern Uttar Pradesh, India. Eastern Uttar Pradesh, India. International Journal of Agricultrual Science and Research, *3*:133-138.