



## EVALUATING THE PLANT EXTRACTS EFFECTIVE AS REPELLENTS FOR SUGARCANE MOTH BORER (*Chilo sacchariphagus*)

D. A. N. S. Dissanayake<sup>1\*</sup>, A. G. B. Aruggoda<sup>1</sup>, S. M. T. A. Maralanda<sup>2</sup> and K. M. G. Chanchala<sup>2</sup>

<sup>1</sup>Department of Agricultural and Plantation Engineering,  
The Open University of Sri Lanka, Sri Lanka

<sup>2</sup>Sugarcane Research Institute, Sri Lanka

Among several pest that affect sugarcane cultivation in Sri Lanka, the sugarcane moth borer (*Chilo sachariphagus*) is a major pest causing severe losses to the crop. Due to the negative effects of traditional control methods that rely on chemicals and insecticides, it is necessary to investigate more environmentally friendly alternatives. This study aims to assess the efficacy of plant-derived extracts as natural repellents against sugarcane moth borers. Six plant materials, namely lantana (*Lantana camara*), marigold (*Tagetes spp.*), wild sunflower (*Helianthus annuus*), cloves (*Syzygium aromaticum*), lemon grass (*Cymbopogon citratus*), and black pepper (*Piper nigrum*), were selected for their potential bioactivity. The extracts were obtained using various extraction methods, including ethanolic extraction for lantana, marigold, and wild sunflower, steam distillation for lemon grass and cloves, and hydro distillation for black pepper. Gel vaporizers were prepared using extracts and field experiments were conducted using a randomized block design. The total number of insects attracted to the sugarcane plants while repellent gel vaporizers were established were recorded and efficacy of the plant extracts as repellents against moth borers were evaluated using Wilcoxon Scores (Rank Sums) test.. Lemon grass and lantana were effective repellent to the sugarcane moth borer i.e., lemon grass ( $p>0.0005$ ), lantana ( $p>0.0007$ ) at 3m distance. Wild sunflower and clove showed attractant to the sugarcane moth borer i.e., wild sunflower ( $p>0.0078$ ), clove ( $p>0.0007$ ). Marigold and black pepper did not show repellence to the sugarcane moth borer i.e., marigold ( $p>0.0964$ ), black pepper ( $p>0.0539$ ). Phytotoxic effect on leaves, retention of odour and keeping quality and yeast and mold count of each was studied in the laboratory. The Highest effective distance was recorded for lemon grass and lantana. It was 9m from the gel vaporizer. Odour retention of all four selected gel vaporizers were in good quality for two weeks period and after two weeks it was in a diminishing trend in an open environment. Under both cold and dry conditions keeping quality was observed to be in good state. According to the results lemon grass and lantana gel vaporizers were effective in repelling sugarcane moth borer into different extends and had good potential in repelling sugarcane moth borer from the plants.

Keywords: moth borer, plant extracts, repellent, sugarcane

\*Corresponding Author: [nilushasandamali96@gmail.com](mailto:nilushasandamali96@gmail.com)



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*The Open University of Sri Lanka*

<sup>2</sup> *Sugarcane Research Institute, Uda Walawe, Sri Lanka*

### INTRODUCTION

Sugar is an important sub-sector of the economy of Sri Lanka. Thus, the sugar sector of Sri Lanka makes a significant contribution to the national balance of payments in addition to its contributions to income and employment generation. Currently, borers (*Chilo sacchariphagus*, Lepidoptera: Pyralidae, and *Sesamia inferans*, Lepidoptera: Noctuidae) can be considered a major pest group in sugarcane in Sri Lanka. An increasing trend of borer damage incidences has been found in sugarcane plantations in Sri Lanka since 2016, and it has reached an economic injurious level in 2019, resulting in poor quality seed-cane production in seed-cane nurseries and a reduction in sugar production due to low juice quality. Also, moth borers have become a problem in the sugarcane crop improvement program during the initial stages.

In pest management, earlier people used plants with pesticidal qualities. Plant-based botanicals are very effective in pest management as they are eco-friendly, less costly, and less harmful to the environment than synthetic pesticides. Botanicals have many properties, including insecticidal activity, repellency, anti feedancy, insect growth regulation, and toxicity to nematodes, mites, and other agricultural pests (Nerio et al., 2010). A repellent can be defined as a behavioral response to a stimulus, and the differences between behavioral responses can be subjective (Miller et al., 2009).

All sugarcane varieties grown on commercial plantations are attacked by several pest species. Because of that, it is very important to have a proper pest management system to minimize pest damage. Regular monitoring of pest infections is essential to avoid pest damage. The moth is generally known as the borer at the larval stage. It belongs to the order Lepidoptera and the family Pyralidae. The moth borer damages sugarcane in all sugarcane-growing regions. It usually infects sugarcane in dry, well-drained areas close to grass. Mature plants are widely injured by the moth bores. Caterpillars bore into the growing points of both small and large cane. This is causing 'dead hearts. Bored stalks sucker and sides hoot, and this usually compensates for damage in young cane. Moth borers have been controlled naturally with the indigenous egg, larval, and pupae parasitoids for a long time, and they remain chronic pests, causing severe and localized losses in some regions. Most sugarcane farmers in Sri Lanka conventionally apply insecticides to control insect pests. Using insecticides causes many kinds of side effects. Long-term use of pesticides may result in the development of target insect pests that are resistant to insecticides, chemicals, and chemical treatments. Hence, it is very important to adopt an environmentally friendly pest control method. The current study was conducted with the objective of studying the effective repellent action of plant extracts on *Chilo sacchariphagus* under natural conditions.



## **METHODOLOGY**

### **Study area**

The study was conducted in the entomology laboratory and the Research farm of the Sugarcane Research Institute (SRI), Udawalawe, Sri Lanka.

### **Experimental Design**

Six different plant extracts (treatments) will be investigated in the field and layout according to the randomized complete block design (RCBD) by using 7 blocks. The plot size of the experiment was 5m × 5m rows and distance between two plots were 12m.

Six different plants named black pepper, lantana, lemon grass, marigold, wild sunflower and cloves were selected for the experiment. Marigold, wild sunflower and lantana were extracted by using ethanol distillation. Lemon grass was extracted by using steam distillation. Pepper was extracted by hydro distillation. Clove was extracted by using soxhlet extraction. Gel vaporizers were prepared by using plant extracts and to identify the best plant repellent for sugarcane moth borer preliminary test and field study was done. The gel vaporizer was made by dissolving plant extracts separately in 15g of gelatine dissolved in 50 ml of boiled water. Two 2-month-old potted plants were established in an insect proof field cage. Positions of the insects and the death count were obtained after 24 hours to determine the repellency and toxicity effect for sugarcane moth borers. To determine the phytotoxic effect two months old potted sugarcane plants were established in an open area and sprayed the prepared plant extract to leaf area and from the first day to twelve days, differentiation of leaves in marked area was observed. To determine the effectiveness of the gel vaporizer field study was done. Moreover, light traps were used to determine the insect population in the areas where treatment was established and controlled. Insect counts were obtained from 7.00pm to 8.00pm. In the nursery gel air vaporizer was established using a stick pole at the canopy height of the sugarcane plants. Standard UV light trap for borer moths was established 3m distance from the treatment and another UV light trap with the same standards was established in 30m distance as a control. After one hour period number of insects attracted to the trap were collected and counted. The test was done for each six treatments ie Marigold, Lemon grass, black pepper, Cloves, Wild sunflower and Lantana in the same way and the test was replicated seven times for each selected treatment. To determine the effective distance of gel vaporizer lantana and lemon grass were established orderly distance of 3m, 6m, 9m, and 12m. In each establishment, distance increased by 3 m after confirming the absence of the vectors at a particular distance. Here light traps were established, left for ½ hr period undisturbed and attracted vectors were counted and recorded carefully. To determine the effective period and retention odor Marigold, Lemon grass, black pepper, Cloves, Lantana and Wild sunflower gel air freshener samples were kept in room temperature (20-22<sup>0</sup>C) and cool environment (0-3<sup>0</sup>C) and their odor, appearance and colour were observed daily. Yeast mould count and Total plate count were taken to determine the keeping quality of the gel vaporizer.

## **RESULTS AND DISCUSSION**

According to the laboratory results, death of the insects recorded in the insect cages where lantana treatment was placed on the sugarcane plants. In the marigold treatment, the insects were observed on the roof of the insect cage. In the wild sunflower treatment, one insect found in the control side and one insect found on the wall of insect cage.

After spraying the selected repellents phytotoxic effect for sugarcane leaves was observed for 12 days and among them there was no phytotoxic effect was observed on leaves due to spraying of lemon grass, lantana, marigold, wild sunflower, clove and black pepper extracts. Slight yellowing appearance was observed in pepper extract sprayed leaves after day eight on leaf lamina. A rough nature was observed in lantana extract sprayed leaves (Fig.4.3) after day three on leaf lamina.



According to the field study, these results were found. Lantana and lemon grass treatments showed significant repellence to the sugarcane moth borer ie, lantana ( $p>0.0007$ ) and lemon grass ( $p>0.0005$ ). Marigold and black pepper treatments showed significantly no repellence to the sugarcane moth borer ie, marigold ( $p>0.0964$ ), black pepper ( $p>0.0539$ ). Wild sunflower and cloves were significantly effective to the sugarcane moth borer ie, wild sunflower ( $p>0.0078$ ) and cloves ( $p>0.0007$ ). Wild sunflowers and cloves acted as an attractant to the sugarcane moths. In relation to the effective distance of selected repellents lantana and lemon grass were recorded 9m ( $9a\pm 0$ ) from the gel vaporizer.

Odor retention of all six selected gel vaporizers was in good quality for a 2-week period and after 2 weeks it was in a diminishing trend in open environment. There was no change in appearance or color recorded in all the gel vaporizer samples in cold environment (Refrigerator condition) for one week period and after 4-week period after preparation.

For all the prepared gel vaporizers yeast and mold count was zero at initially. A zero yeast and mold count in a product can be interpreted as a positive quality indicator. Total plate count is often used as a quality control measure. In many cases, lower Total plate count values are desirable, as they indicate better product quality and reduced risk of spoilage. Gel air freshener was prepared by following the literature review. Light traps were used to determine the insect population in the areas where treatment was established and controlled. Insect counts were obtained from 7.00 pm to 8.00 pm. After one hour period number of insects attracted to the trap were collected and counted. Test was done for each six treatments ie Marigold, Lemon grass, Pepper, Cloves, Wild sunflower and Lantana in the same way and test was replicated for 3 times for each selected treatment.

To determine the effective distance of the gel air freshener lemon grass and lantana gel air fresheners were established in the field. Those were established orderly distances of 3m, 6m, 9m, and 12m. In each establishment, distance increased by 3m after confirming the absence of the vectors at the distance. Here light traps were established, left for  $\frac{1}{2}$  hr period undisturbed and attracted vectors were counted and recorded carefully. Marigold, Lemon grass, Black pepper, Cloves, Lantana and Wild sunflower gel air freshener samples were kept in an open environment and cold environment odor, colour and appearance retention were observed daily. Plate Count and Yeast and mould count were done to determine the quality of gel air freshener.

## **CONCLUSIONS/RECOMMENDATIONS**

Lemmon grass and lantana showed repellence to the sugarcane moth borer. Wild sunflower and cloves showed attractant to sugarcane moth borer. Marigold and black pepper do not show effectiveness in both applications. In relation to the effective distance of selected repellents, the highest distance was recorded for lantana and lemon grass. It was 9m from the gel vaporizer. Odour retention of all four selected gel vaporizers were of good quality for 2 weeks period and after 2 weeks it was a diminishing trend in open environment. Under both cold and dry conditions keeping quality was observed to be in good state, for all the prepared gel vaporizers yeast and mold count was zero at initially. Additional trials are needed to study the effective time of the odour of gel air fresheners in the field.

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