Efficacy of Rose Bangle (Lantana Camara L.) Leaf Extract in Controlling Corn Borer (Ostrinia Furnacalis) and Corn Earworm (Helicoverpa Zea) of Sweet Corn(Zea Mays Var. Saccharata)

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Abstract – *The study on the efficacy of Rose Bangle leaf (Lantana camara L.) extract was conducted to determine the incidence of corn borer and corn earworm in the different treatment, assess damage done by corn borer and corn earworm, determine the yield in the different treatment and to determine the profitability by doing simple cost and return analysis of the different treatments. The experiment was carried out using Randomized Complete Block Design (RCBD) and was laid out with five (5) treatments with three replications.*

Results of the study revealed that Rose Bangle leaf extract specifically at 1:1 leaf and water ratio is effective in controlling corn borer and corn earworm as it obtained the lowest mean count of corn borer and corn earworm, lowest infestation rate of corn borer. Moreover, this treatment also recorded highest mean yield of green corn and highest net income. T4 (Synthetic Insecticide - Cypermethrin), however, manifested the lowest infestation rate of corn earworm, obtained the heaviest mean weight of green ear and highest return on investment.

The study recommends the use of Rose Bangle (Lantana camara L.) leaf extract with 1:1 (leaves and water ratio) in controlling corn borer and corn earworm and other minor insect pest,

Keywords *- Rose bangle extract, corn borer, corn earworm, sweet corn*

INTRODUCTION

Corn (*Zea Mays var. Saccharata*) is an important crop in the Philippines. Data from the Bureau of Agricultural Statistics reveal that the country is almost sufficient in corn at 99% and one of the general varieties is Sweet corn. Sweet corn, table corn, or sugar corn, is one of the sweetest, most important staple crop next to rice. Scientifically, sweet corn is called *Zea mays var. Saccharata*, a cultivar of field corn (*Zea mays L.*). Production of special types of corn such as popcorn, waxy (or glutinous) corn, high lysine/tryptophan corn, and sweet corn was found to be very promising as livelihood for farmers. This is because sweet corn is simpler to grow, labor-saving, less prone to insect pest infestation, and is oftentimes more profitable than growing corn for grain.

Corn is a good source of the phenolic flavonoid antioxidant, ferulic acid**.** It also contains good levels of some of the valuable B-complex group of vitamins such as thiamin, niacin, pantothenic acid, folates, riboflavin, and pyridoxine. Many of these vitamins function as co-factors to enzymes during substrate metabolism. Further, it contains healthy amounts of some essential minerals like zinc, magnesium, copper, iron, and manganese [1]. It helps in alleviating symptoms of kidney problems, including renal dysfunction, can provide relief for gout, gives the body more energy, since it is a body building food, and contains dietary fiber that may prevent constipation, and iron that may prevent symptoms caused by anemia.

Corn earworm *(Helicoverpa zea)* is potentially the greatest threat to sweet corn production. Because it feeds directly on the market product, is difficult to control, and is common in high numbers at the end of the season, most insecticides used on sweet corn target this pest. Once earworm has become established within the ear, control is nearly impossible. Earworms spend a relatively short period of their life feeding in a site that can receive an adequate insecticide application. An effective program, especially on late season corn, is necessary to ensure that damaged ears are kept to a minimum [2].

Corn borer *(Ostrinia furnacalis)* is a species of moth in the family Crambidae, the grass moths. It is known by

the common name Asian corn borer. Its distribution extends from China to Australia. It is well known as an agricultural pest on several crops, especially corn. It is one of the worst corn pests in Japan and China. It has invaded corn crops in Guam and the Northern Mariana Islands. It can be found in Java, Sulawesi, the Philippines, Borneo, New Guinea, the Solomon Islands, and Micronesia. It is likely the worst pest insect on corn in the western Pacific region of Asia, and one of the worst pests overall, second only to maize downy mildew. This moth is a close relative of the European corn borer [3].

Currently, the primary insecticides used for corn borer and corn earworm control in sweet corn belong to the pyrethroid class. There is growing concern that corn borer in some regions of the Midwest has developed resistance to this class of insecticides.

Rose Bangle (*Lantana camara L.)* is a heavily branched shrub that can grow in compact clumps, dense thickets or as a climbing vine. Studies conducted have demonstrated that extracts from the leaves can be employed to combat antimicrobial, fungicidal, insecticidal and nematicidal problems. Its potential to serve as biocide has also been described by several scientists[4].

In the Philippines, Lantanas are abundant and locally available. It is usually used as corner or border plants. They are very tolerant and floriferous plants, almost providing flowers all year round. It found to be toxic to livestocks particularly cattle, sheep and horses[5].

The exploration of the efficacy of using Rose Bangle (*Lantana camara L.)* leaf extract for controlling corn borer and corn earworm of sweet corn is one way of finding alternative for chemical pesticides which are hazardous to health as well as to the environment. This study will help farmers living in remote areas who have no financial capability to access costly prepared insecticides by using this plant Rose Bangle (*Lantana camara L.)* that is widely distributed in the province yet unused resource.

OBJECTIVES OF THE STUDY

In general, the study was conducted to test the efficacy of Rose Bangle (*Lantana camara L.)* leaf extracts in controlling the incidence of Corn Borer and Corn Earworm of Sweet Corn. Specifically, it aimed to determine the incidence of corn borer and corn earworm in the different treatment; assess damage done by corn borer and corn earworm; determine the yield in the different treatment; and determine the profitability by doing simple cost and return analysis of the different treatment.

MATERIALS AND METHODS

Yellow Sweet F1 variety was used. Yellow Sweet F1 is an excellent performing sweet corn hybrid for sub-tropical and tropical growing conditions. Cobs are of excellent quality, medium in size with good tip fill and highly uniform in size ranges from 18-20 cm ear length. The color of the kernel is bright yellow and the taste is outstanding due to its high sweetness. The weight of the ear ranges from 250-300 grams. It matures at 75-85 days after planting. The potential yield of Yellow Sweet F1 is 10.4 to 12.5 tons per hectare.

The experimental area was thoroughly cultivated prior to planting. Initial plowing was done by a tractor for a deeper cultivation and left idle for 2 weeks. This was done to prevent growth of weeds, to pulverize the soil, to level the field and to give ample time for the weeds to be decomposed. Second plowing and harrowing was done at a week interval.

A total area of 336 square meters was laid-out in three equal blocks with 2 meters between blocks. Each block was subdivided into five plots, each plot measuring 3 meters wide and 4 meters long with a distance of 1.5 meter between each other. The treatments were allocated following the randomization procedure of the Randomized Complete Block Design (RCBD).

The following treatments were used in the study: T_1- 1:1 leaves and water ratio; T_2- 1:2 leaves and water ratio; T_3- 1:3 leaves and water ratio; T_4- Synthetic Insecticide (Cypermethrin); and T_5- Control (No Insecticide).

Fertilizer was applied following the recommended rate based on the result of soil analysis in which some of the nitrogen and all of the phosphorus and organic fertilizer (Vermicast) required was applied along furrows as basal. The remaining nitrogen requirement was applied in each plot before off-barring and hilling-up.

Off-barring was done at 20 days after planting and hilling-up was done 30 days after planting to loosen the soil around the crop for proper root development and to minimize the occurrence of weeds.

The plants were manually watered uniformly as the need arises. Carageenan extract (Plant Food Supplement) was also applied during the vegetative stage with 10 ml diluted in 1 liter of water and was applied equally in every plot to enhance growth and development of the crop.

Fresh leaves (including new shoots down to matured leaves) of the Rose Bangle *(Lantana camara L.)* plant were collected from the fields near the experimental area and were chopped into small pieces. The chopped leaves were osteorized with potable water following the different treatment ratios. The osteorizer was run until the leaves were grated into fine fibers. The fluid portion was separated with the use of strainer and was placed in a bottle. Extraction of fresh leaves was done on the day of application.

Extracts and chemicals were applied immediately two weeks after germination since it was observed that there were occurrences of minor insect pest during the seedling stage like cutworms that feed on the shoots of the plant. Application was done simultaneously and repeated at weekly interval thereafter since there are three morphology cycle of corn borer in one production period, hence, protection of plants from corn borer invasion and other insect pest was needed.

The corn ears were harvested early in the morning at 80 days after planting. Representative sample plants per plot were harvested first and were put in a properly labelled sack after which the whole plot was also harvested.

The rate of corn borer and earworm infestation was determined by using the formula.

$$\text{Infestation Rate Percentage (\%)} = \frac{\text{Number of Damaged Leaves}}{\text{Total no.of Leaves per plant}} \times 100$$

Damage rating by corn borer and corn earworm on the leaves and ears were determined by using the rating guide of the International Crop Research Institute for the Semi-Arid Tropics.

Ten (10) sample plants were selected from the inner rows of every experimental crops where all the data were gathered which were then summarized, tabulated and analysed following the analysis of variance for the Randomized Complete Block Design (RCBD).

RESULTS AND DISCUSSION

Corn Borer Incidence

The incidence of corn borer was monitored starting on the 2nd week after emergence (WAE). Incidence of Corn borer started at 4th week after emergence until 9th week after emergence.

Table 1 shows that the incidence of corn borer was very low, T_1 has the lowest mean count of 0.007 followed by T_4 and T_2 with the same mean count of 0.014, next was T_3 (0.028) and the highest was T_5 (0.097). On 8 WAE, incidence of corn borer in Treatment 5 is lower than Treatment 3 since there is a sample plant in T_5 that was severely attacked and damaged by corn borer at vegetative stage and eventually died before reaching the tasseling stage. Statistical analysis of data, however, showed no significant difference among the treatments. This implies the leaf extracts used at different ratios have comparable effect with that of synthetic insecticide in controlling corn borer.

This finding confirms the study of Sathish (2008)[6] where he studied the methanolic and ethanolic extracts of Rose bangle (*Lantana camara L.)* and found to have an advanced larvicidal rate against *Aedes aegypti*, while in the *Culexquinque fasciatus* diversity, the concentration of extracts have to be improved for better larvicidal effect. The highly-complex combinations of these compounds was materialized as an efficient environmentally-safe vector and pest managing agent

Table 1. Weekly mean count of Corn Borer

Treatment	W2	W3	W4	W5	W6	W7	W8	W9
T_1	0	0	0	0.08	0	0	0	0
T_2	0	0	0.17	0	0	0	0	0
T_3	0	0	0	0	0.08	0	0.25	0
T_4	0	0	0	0	0.08	0	0.08	0
T_5	0	0	0.42	0.33	0.25	0.08	0.08	0
Anova	ns	ns	ns	ns	ns	ns	ns	ns

ns- not significant

Infestation Rate of Corn Borer

The infestation rate of corn borer was taken in the different growth stages of the plants specifically the vegetative, flowering and fruiting stage using the rating guide from ICRISAT.

Table 2. Infestation rating on Corn borer in the vegetative stage

	Vegetative		
Treatment	Mean Rating (%)	Scale	Description
T_1	0%	1	Clean
T_2	0.48%	2	Low
T_3	0.93%	2	Low
T_4	0.42%	2	Low
T_5	1.33%	2	Low

As shown in the Tables 2, 3, & 4, the treatment that obtained the highest infestation rate during vegetative stage was T_5 (Control) with a mean of 1.33% followed by T_3 with a mean of 0.93%; T_2 with a mean of 0.48%, T_4 with a mean of 0.42% and the lowest was T_1 with a 0% mean. During the flowering stage T_5 has the highest

infestation rate with a mean of 1.15% followed by T_3 with 0.58% and the lowest was T_4 with a mean of 0.33%. During the fruiting stage T_5 has the highest infestation rate with a mean of 0.81% followed by T_3 with 0.58% and T_4 with 0.54%. The findings revealed that the scale on infestation rate of corn borer at different growth stages of sweet corn is remarkably low.

Table 3. Infestation rating on Corn borer in the flowering stage

	Flowering		
Treatment	Mean Rating (%)	Scale	Description
T_1	0%	1	Clean
T_2	0%	1	Clean
T_3	0.58%	2	Low
T_4	0.33%	2	Low
T_5	1.15%	2	Low

Table 4. Infestation rating on Corn borer in the fruiting stage

	Fruiting		
Treatment	Mean Rating (%)	Scale	Description
T_1	0%	1	Clean
T_2	0%	1	Clean
T_3	0.58%	2	Low
T_4	0.54%	2	Low
T_5	0.81%	2	Low

Incidence of Corn Earworm

Incidence of corn earworm occurred and was observed only on the 11th week after planting. Figure 3 shows the incidence of corn earworm in every treatment where, T_5 had the highest mean count of 0.36 followed by T_3 with 0.34; T_4 with a meant count of 0.25, T_2 with 0.11 and the lowest was T_1 (0.08). Statistical analysis of data showed no significant difference among the treatments. This means that the leaf extract of Rose Bangle (*Lantana camara L.)* used in controlling corn earworm at different ratios have comparable effect with synthetic insecticide.

This finding confirms the study of Deshmukhe et al. (2008)[7] where they studied the effect of *Lantana camara* (L.) on growth development and survival of tobacco caterpillar and stated that topical and leaf application of crude aqueous extract of *Lantana camara* (L.) leaves are highly effective in controlling lepidopteran pest.

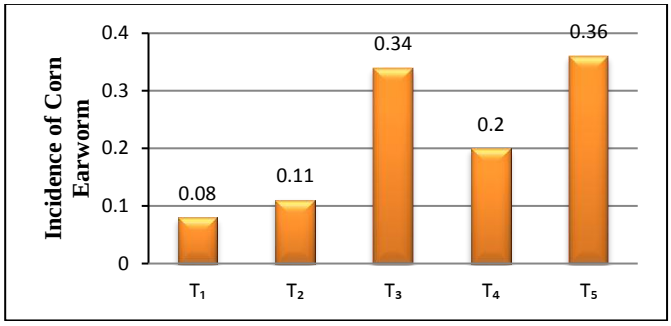

Figure 3. Mean incidence of Corn Earworm

Table 5. Infestation rating of Corn Earworm

Treatments	Mean Rating	Scale	Description
T_1	0.08%	2	Low
T_2	0.11%	2	Low
T_3	0.34%	2	Low
T_4	0.2%	2	Low
T_5	0.36%	2	Low

The infestation rate of corn earworm on the ear is shown in the Table 5. The treatment that obtained the highest infestation rate was T_5 (Control) with a mean of 0.36% followed by T_3 with 0.34%; T_2 with 0.11%; T_1 with 0.08% and the lowest infestation rate was T_4 with a mean of 0.2%. Among the 5 Treatments, T_5 had the highest infestation rate and the scales in every treatment were interpreted as "Low". The findings revealed that the insect infestation at different growth stages of sweet corn is remarkably low.

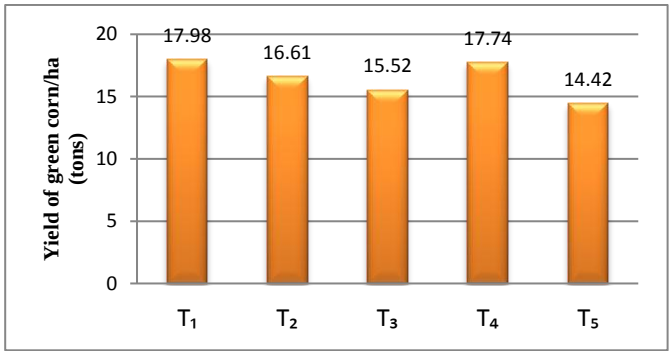

Figure 2. Green Corn Yield per hectare (tons)

Figure 2 presents the computed yield (based on plot yield) of green corn per hectare in the different treatments. As shown in the graph, the treatment that obtained the highest yield was T_1 with a mean yield of 17.98 tons followed by T_4 with a mean yield of 17.74

tons; T_2 with 16.61 tons and T_5 with 15.26 tons and the least was exhibited by T_3 with a mean yield of 14.67 tons. Statistical analysis of data however showed that there is no significant difference among treatments.

Simple Cost and Return Analysis

Cost and return analysis based on projected yield of green corn per hectare was done to determine the profitability of the project. Projected cost and return analysis showed that yield from T_1 got the highest net income with ₱485,655.00 followed by T_4 with ₱485,150.00; T_2 with ₱450,478.00; T_3 with ₱418,885.00 and the least was T_5 with ₱390,700.00. The treatment that obtained the highest ROI was T_4 which is the use of Cypermethrin with 1,051.24% which means that for every 1 peso invested there is ₱1,051.59 return.

CONCLUSION AND RECOMMENDATION

Based on the results of the study, the following conclusions were drawn: 1) Rose Bangle leaf extract specifically at 1:1 leaf and water ratio is effective in controlling corn borer and corn earworm; 2) T_1 (1:1 leaves and water) obtained the lowest mean count of corn borer and corn earworm, lowest infestation rate of corn borer, highest mean yield of green corn and highest net income; and 3) T_4 (Cypermethrin) gave the lowest infestation rate of corn earworm on the ear and obtained the heaviest mean weight of green ear and highest return on investment. [add]

This finding is important as it shows that sweet corn farmers can make use of Rose Bangle extract in effectively controlling corn borer and earworm. This may likewise provide a possibility for this unused and usually considered of no economic value weeds to become useful instead of just posing problem on its control and disposal as it is considered an invasive weed specie and also a great threat to small ruminant raisers as it is toxic when consumed by their animals. The utilization of this resource may also contribute to the production and supply of a safer and pesticide-free sweet corn for the consumers.

Based on the findings of the study, the following are recommended: 1) the use of Rose Bangle (*Lantana camara L.*) leaf extract with 1:1 (leaves and water ratio) in controlling corn borer and corn earworm and other minor insect pest is highly recommended and 2) since the study was conducted during the dry season where most often, the incidence of corn borer and earworm is low, a follow up study is recommended during wet season and in other places to validate the findings of the study.

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