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What is the effect of the cyanogen in cassava leaves on *Drosophila melanogaster* larvae?

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ABSTRACT

Biopesticides made from plants are the new alternative for getting rid of insects that are pests. The use of chemical insecticide is not the best way to control pests anymore because it causes the development of resistance in insects and affect other organisms that are not targeted. In this study we investigate the effect of the cyanogen in cassava leaves on the model organism *Drosophila melanogaster*. The larvae were subjected to 3 different concentration in three trials. The results of the first trial with the 100 ml of DI water showed that there was 25 flies out of the 100 larvae that emerged, with the 80ml of DI water the emergence was of 63 flies out of a 100 and with the 25 ml of DI water the result was an emergence of 71 out of a 100. The results of the test of significance showed that the power of this experiment with alpha = 0.050 is 0.64 therefore there is no effect and the observed difference in the number of emerging flies is due to random variation. The cyanogen in cassava leaves have no effect on the *Drosophila melanogaster* larvae.

Keywords: *cassava leaves, Drosophila melanogaster, cyanogen*

INTRODUCTION

Manihot esculenta, also known as cassava, is a woody shrub originating from South America. The plant is widely cultivated in tropical and subtropical regions for the starchy tuberous root it produces which is a major source of carbohydrates. After rice and maize, cassava is one of the largest sources of carbohydrates in the tropics. Cassava is a staple crop because of its ability to grown in difficult conditions like drought. (Shuan, et al., 2018)

Cassava leaves are considered a byproduct of the plant because it is mainly grown for its roots. Cassava leaves are a good source of protein but the cyanogenic glucosides they contain limit the potential the plant has to feed a large number of people. The major cyanogenic glucoside in cassava leaves is linamarin but the plant has 95% of linamarin and 5% of lotaustralin. With hydrolysis, linamarin turns into hydrogen cyanide. Hydrogen cyanide causes diseases like tropical ataxic neuropathy (TAN) and konzo, a common disease in Africa. (Zidenga, et al., 2017)

It is known that a fatal dose of cyanide for humans can be as low as 1.5 mg/kg body weight. A 300g portion of bitter cassava could easily contain enough cyanide to cause death in children and adults. In a study they looked at the effect of cyanide in rats, they developed a method in which a pipette was used to put a sodium cyanide solution into the cheek, and the rat then swallowed the solution. When the doses of cyanide were higher than 16 mg/kg the rats showed signs of being intoxicated that happened quickly from head burial and mastication to lethargy, convulsions, respiratory distress, and death. (Rice, et al., 2018)

We know that cassava leaves are dangerous to humans when eaten raw, the study mentioned below examine and found methods that are able to make cassava and cassava leaves completely safe for consumption. Four different methods have been found effective to detoxify cassava leaves: thermal, sodium bicarbonate, enzymatic, and ultrasonic treatments. (Latif, et al., 2019)

One important step in finding a way to eliminate the cyanogenic potential in cassava is discovering why cassava produces the 95% of linamarin and 5% of lotaustralin. A hypothesis to explain this is that cassava produces these cyanogen as a mechanism of defense against arthropod pests. (Riis, et al..,2003)

Currently there are methods to cure cyanide poisoning. The approved antidotes require intravenous administration but there is a research that resulted in a method that would increase the utility of the antidote in a mass casualty scenario. This study found that intramuscular dimethyl trisulfide is effective. (Hofer, et al., 2018).

The objectives of this research on the effect of the cyanogen in cassava leaves on the *Drosophila melanogaster* larvae is to find out what concentration of cassava leaves is fatal to the insect. This research is importance because it is going to tell what concentration of cassava leaves is fatal for the *Drosophila melanogaster* larvae thus allowing us to find ways to use the toxicity of cassava leaves to our advantage. Cyanide is a rapidly acting, potentially deadly chemical that can exist in various forms. Knowing if the cyanogenic glucosides in cassava leaves can kill the larvae, will tell us if cassava leaves could be used in plant-mediated biopesticides as an alternative source for the management of insects. Today the use of chemical insecticides has caused development of resistance in insects. Chemical insecticides have a bad effect on the environment and are harmful to organisms that are not meant to be affected. A research has found that *Manihot esculenta* or cassava leaf extracts is an alternative to chemical insecticides for the management of *S. litura* larvae and it can also be used for the control of other insect that can be pests. (Manjula, et al.., 2020)

MATERIALS AND METHODS

The dried cassava leaves were obtained from the online store Etsy. The extraction of the cassava leaves was done using a blender. To obtain the extract at 3 different concentrations 10g of dried cassava leaves was blended with 100 ml, 80 ml and 25ml of deionized water.

For the *Drosophila melanogaster,* two stock vials each containing 6 of the sepia flies were prepared. The two vials having in total 12 flies both contained males and females. For the first trail of the experiment 10 vials set up with the medium for the larvae which is essentially made of the potato flakes, 17 ml of deionized water and yeast for nutrition and 10 others vials will have the medium with the potato flakes, 17ml of cassava leaves extract with also the yeast for nutrition. Each of the 20 vials will have 10 larvae transferred from the stock vial which in total will make 100 flies subjected to only the deionized water for control and 100 larvae subjected to the cassava leaves extract. The vials will be monitored for the number of flies that will emerge and how long it will take for them to emerge.

RESULTS

Table 1. Number of emerging flies out of 100

	Trial 1	Trial 2	Trial 3
control	15	23	20
treatment	25	63	71

X^2= 3.418 with 2 degrees of freedom. (P = 0.181)
The proportions of observations in different columns of the contingency table do not vary from row to row. The two characteristics that define the contingency table are not significantly related. (P = 0.181). Power of performed test with alpha = 0.050: 0.360. The power of the performed test (0.360) is below the desired power of 0.800. Less than desired power indicates you are less likely to detect a difference when one actually exists.

DISCUSSION

Cassava leaves contain a cyanogen that help the plant protect itself against microbes and insects. In an earlier study on the effect of *Manihot esculenta* (Crantz) leaf extracts on antioxidant and immune system of *Spodoptera litura* the results showed a high mortality using petroleum benzene leaf extract. (Manjula, et al.., 2020)

The results of that study proves that the extract using petroleum benzyne is a good insecticide against the *Spodoptera litura larvae.* However, the present study showed that the cassava leaves extract has no effect on the Drosophila melanogaster larva. The results of the test of significance on this experiment showed that the power of performed test with alpha = 0.050: 0. 360. The power of this test shows that there is no effect and that the difference in emerging flies that the result show might be dure to random variation.

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