

**MAKERERE**



**UNIVERSITY**

**SAFETY ASSESSMENT OF CYSTATINS USED TO CONTROL  
PESTS IN TRANSGENIC BANANAS IN UGANDA**

**BY**

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**A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE  
STUDIES IN PARTIAL FULFILLMENT FOR THE AWARD OF**

**MASTER OF SCIENCE IN FOOD SCIENCE**

**AND**

**TECHNOLOGY OF MAKERERE UNIVERSITY**

**2009**

**FACULTY OF AGRICULTURE**

**DECLARATION**

I Matovu Moses, certify that this is my original work and that it has not been presented for examination for any award in any University

Date:

Signature

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This thesis has been submitted for examination with our approval as supervisors.

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## ABSTRACT

In this study the safety of the maize and papaya cystatins used to control nematodes and banana weevil borer was assessed by determining the allergenicity and toxicity of the proteins using both *in vitro* as well as the *in vivo* method of oral gavage using albino rats. The maize and papaya cystatins were expressed in *Escherichia coli* strain M15 since this organism is easily cultured. Determination of *in vitro* digestive assays for both cystatins as well as oral feeding of the animals with the cystatins in various concentrations of 10mg, 100mg and 1000mg/kg body weight was carried out followed by sacrificing the animals on the seventh day for clinical and histopathological examination of the blood and animal organs.

The results indicate that the maize and papaya cystatins were fully expressed in the *E.coli* M15 and *E.coli* M15 culture grew well to produce enough protein. The two proteins rapidly degraded in the simulated gastric fluid taking less than 2 minutes to degrade in the pepsin. The maize and papaya cystatins had amino acid sequence similarity with *Actinidia deliciosa* a kiwi fruit of 48.3% and 40.4% respectively over their full length, suggesting that both cystatins are not potential allergens. The results of the amino acid sequence homology comparison with the known toxins in the database did not indicate any relatives, suggesting that these cystatins are not potential toxins. The feed intake data showed that the maize and papaya cystatins did not affect feed intake of the animals. The results of urinalysis, haematology, serum chemistry and organ weights showed that feeding the rats with acute doses of maize and papaya cystatins did not affect the liver and kidneys which play a big role in various metabolic processes. This study shows that the maize and papaya cystatins used to control pests in transgenic bananas in Uganda do not have allergenic and toxic effects. These cystatins may therefore be safely used in transgenic bananas to resist nematodes and weevils.

