MSc Research Progress Report

TITLE:**Evaluation of Selected Diploid Banana Genotypes for Resistance to Weevils (*Cosmopolites sordidus*) and their agronomic performance in Uganda**

Name of Student: **Kemigisa Juliet**

Field of study:**MSc of Science in Botany (Microbiology and Plant pathology)**

University: **Makerere University- Uganda**

Timeline of study: **1st August 2016 to 31st July 2019**

Supervisors: **Dr. Robooni Tumuhimbise(**NARO), **Assoc. Prof Arthur K. Tugume**(Makerere University)

Research Objectives

1. To assess the response of selected diploid banana genotypes to weevil infestation

2. To determine the field performance of selected diploid banana genotypes for agronomic traits and pollen quantity

3. To evaluate the effectiveness of the pot bioassay on screening bananas for response to weevils as compared to field evaluation

Achievements

1. Successfully completed course work at Makerere University and submitted the research proposal to the higher academic committee.
2. Screened 12 selected genotypes in the pot and field trials for weevil resistance.
3. Thesis draft writing and submission for review to the university supervisor (still under review and waiting final submission)

Background

In Uganda, bananas are a staple and main source of income for many smallholder farmers that rely on the crop for their livelihoods. Banana production in Uganda achieves less than the expected potential yield of 70t/ha/yr due to pests, diseases and other abiotic factors such as declining soil fertility. Pests of major concern are the banana weevils with estimated yield damages of 14 to 60% andhave led to the disappearance of some popular local East African Highland cultivars.Attempt to control weevils by cultural, biological and chemical methods are feasible but not sustainable due to limited resources to farmers, since these methods are laborious, costly and harmful to the users and the environment.

Breeding for host resistance to weevils holds promise as the best control measure against weevils but has not been fully utilized because of lack of research into resistant sourcesof banana weevils. This MSc study focuses on identifying sources of resistance to weevils from selected diploid banana genotypes and to determine their agronomic value in support of breeding. This will consequently benefit small-scale banana farmers through growing improved weevil resistant varieties, reducing labour costs and chemical use. This will also result into increased banana production and sustainable productivity.

Summary of the study

- Nine banana genotypes were sourced from the International Transit Centre (ITC)-Bioversity International and multiplied in the tissue culture lab at NARL. The nine diploids belong to 'The Pisang Jari Buaya family' and their resistance to weevils was unknown.The diploids assessed include Morong Datu, Pisang Gigi Buaya, Pisang Tunjuk, SH-3142, Pisang Rotan, Huwundu vita, Gabah Gabah, Morong Princessa and Saing- Hil. Selection of the diploids was based on their resistance to *Radopholussimilis.*They were evaluated for weevil resistance in the pot bioassay and field trial.
- Four controls were obtained from the NARL plantations in Kawanda. One genotype (Calcutta 4) obtained from Kawanda is used as a male parent and is resistant to major pests and diseases (Kiggundu et al., 2003). Three others are triploids, the EAHBs (Kibuziand Nakitembe) are highly susceptible to banana weevils while Kayinja is resistant.

- The pot screening bioassay grouped the selected diploids genotypes into resistant (Pisang Tunjuk, Saing Hil, Morong Datu and Pisang Rotan) and intermediate (Pisang Gigi Buaya, Huwundu Vita, Gabah Gabah and SH-3142), none was susceptible in relation to the reference genotypes Nakitembe.The resistant genotypes showed the lowest weevil damage on the peripheral, cross section of the corm and the overall total damage as compared to the intermediate and susceptible genotypes.
- Further screening of the genotypes in the field revealed that all the nine selected diploids were resistant to weevils. The intermediate response in the pot bioassay could be because the plantlets used were young and had not fully developed their defence mechanism.
- Pollen quality and quantity is an important attribute during conventional breeding. Six of the diploids had pollen quantity above 1 (scale 1=low pollen, 4=much pollen), three of the genotypes much as they are resistant to weevils, they lack pollen. Plant agronomic and yield performance were recorded for all the genotypes evaluated.
- Field evaluation for resistance to weevils is a traditional,long and costly method used to determine resistance. Pot evaluation predicts resistance in eight months, cheaper compared to field,so cannot be ignored but rather improved. Correlation analysis of the weevil damage traits obtained from pot and field evaluation indicated a low positive correlation. Selection of materials for resistance to weevils using pot evaluation should be done carefully so as not to lose out important clones. It is important to increase the selection scale or gap because the plant materials used are too small to defend themselves. The pot experiment also subjects the materials to the micro climate that is created by the shielding net hence might affect the overall weevil behaviour. Enclosing the weevil subjects it to forced survivor even on the resistant genotypes. The overall observation is that the pot screening experiment is valid in grouping genotypes into resistant and susceptible. Selection of resistant genotypes for resistance to weevils while using the pot experiment should as well include the intermediate as resistant.

Conclusion

The diploids showed differing agronomic traits and good source of weevil resistance. Based on the agronomic and yield data obtained, some selected diploids exhibited good banana breeding traits. Most of the diploids are suitable parents for use in generating new improved genotypes as they comprise multiple traits for easy and fast breeding cycle.