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Survey and Comparative Detection of the Fungi Associated with Vascular Streak Dieback (VSD) Disease in Cacao-Growing Areas of the Philippines

GRANTEE: University of the Philippines Los Baños Foundation, Inc. (UPLBFI)

PRINCIPAL INVESTIGATOR: Prof. Johnny Balidion

US UNIVERSITY PARTNER: North Carolina State University (NCSU)

COLLABORATING PARTNERS: Cavite State University (CvSU)

GRANT PERIOD: June 1, 2015, to July 31, 2016

CONTRACT AMOUNT: Php 4,299,250 (approximately USD91,500)

Saving the cacao industry

The Philippines was a major supplier of cacao globally in the 1960s and 1970s. However, the significant decline in number of cacao bearing trees, farming challenges such as widespread uncontrolled cocoa pests and diseases, and drastic changes in climate or weather conditions like the *El Niño* phenomenon and strong typhoons led to the gradual decrease in cacao production.

With vascular streak dieback (VSD) disease in cacao expected to escalate due to the increasing movement of cacao germplasm, a team of researchers from UPLB, with support from USAID STRIDE, initiated the development of a practical pathogen diagnostic tool that will focus on the VSD disease caused by several species of the pathogenic fungus *Ceratobasidium*.



Cacao leaves showing symptoms of Vascular Streak Dieback disease

Information generated by the diagnostic tool will be utilized for early diagnosis, screening, monitoring, and quarantining of disease-resistant genotypes to prevent possible epidemics in high-risk areas and salvage the cacao industry.

Milestones

This study achieved the following:

- Collection of 1,170 samples from identified sampling locations/ regions, namely; Northern Luzon, CALABARZON, Bicol, Central Visayas, Eastern Visayas, MIMAROPA, SOCSARGEN, and Davao;
- Collection of 1,159 VSD-associated fungi from Laguna, Quezon, Northern Luzon, Bicol, Central Visayas, and Davao;
- Isolation and categorization/ grouping of VSD-associated fungi according to cultural characteristics with 12 types recognized in the entire collection where 8 are VSD-symptomatic, indicating high possibility of VSD-associated fungi;
- Observation that the polymerase chain reaction (PCR) amplification using the Internal Transcribed



A field technician orients Dr. Cubeta of the cacao bean processing methods employed by Kennemer Foods International during our visit at the bean buying station at Calinan District, Davao City

- Spacer 4 and 5 primers produced the expected amplicon size for all isolates, approximately 650 bp, and the results of the sequence analysis confirm the presence of *Ceratobasidium theobromae* and *Ceratobasidium ramicola* in the samples collected specifically from Mindanao;
- Observation that the entry of the VSD pathogen, *C. theobromae* starts from the leaf through the leaf veins, then to the petiole, and finally the stem;
- Verification that cacao polyphenols and impurities present in the extracted DNA have a negative effect on the PCR tests using the extracted DNA;
- Verification that symptomatology is not a reliable criterion for conclusions on the presence of *C. theobromae*; and
- Discussion and presentation of results for further analysis were undertaken with NCSU to strengthen the establishment of needed protocols such as correct diagnosis, timing of implementation, and management strategies to control VSD.

The one-year study achieved its objectives with the development of an effective detection scheme for pathogens causing VSD disease. The diagnostic tool that was developed will be very useful in creating evaluation criteria for disease-resistance screening of cacao genotypes in cultivation sites, which in the long run will also contribute to the biosecurity framework for cacao farming in the Philippines.