DAAD-RISE WORLWIDE 2023

Project Name: Tocopherols and tocotrienols profile in Costa Rican commercial rice varieties and their potential as biomarkers of longevity in rice seeds.

Short title: Vitamin E and its potential as biomarker of longevity in rice seeds.

Internship Provider: Centro para Investigaciones en Granos y Semillas (CIGRAS) (Seed and Grain Research Center). University of Costa Rica.

Webpage: http://www.cigras.ucr.ac.cr/en/

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Time of the Internship: 01 June 2023-31 August 2023 (for stays of maximum three months is not necessary a student Visa)

Background

The project aims to study the tocopherols and tocotrienols (vitamin E) profile in Oryza sativa varieties from Costa Rica and compared them with genotypes from the germplasm bank from USDA.

This will help to establish the basis for evaluating their potential as biomarkers for rice seed's longevity and quality. Recent studies show that these compounds, due to their antioxidant properties, contribute to extending the longevity of rice seeds. Measuring seed longevity is an important feature since, as it is an indicator of viability and vigor, it can be extrapolated to the germination capacity of the seed.

Recent publications determined that some allele variations in genes associated with the regulation of the levels of tocopherols and tocotrienols in rice were related to an extension in seed longevity.

In the first part of the project, was identified the allele variation in two genes associated with the levels of tocopherols and tocotrienols observed in the rice genotypes of Costa Rica.

The next objective seeks to confirm the possible role of tocopherols and tocotrienols as biomarkers for rice seed longevity in rice varieties grown in Costa Rica.

To accomplish this goal, we aim to measure parameters associated with seed viability and seed vigor through accelerated aging tests. These parameters will be measured with modern techniques (image analysis) and also by standard tests.

Finally, the content of tocopherols and tocotrienols will be measured in the rice seeds before and after the accelerated aging tests, and possible correlations between seed longevity, seed vigor parameters and tocopherols and tocotrienols content will be studied.

Scientific research question

¿Are tocopherols and tocotrienols related with seed longevity in Costa Rican selected rice varieties?

Experimental approach

We aim to measure parameters associated with seed longevity and seed vigor through accelerated aging tests in 11 selected rice varieties from Costa Rica and genotypes from the germplasm bank.

For the accelerated aging tests, rice seeds with 12% humidity will be incubated at 95% relative humidity for 48 and 96 hours. For reaching 95% relative humidity a non-saturated solution of sodium chloride will be used. After each incubation time (48 h and 96 h), germination tests will be performed in germination chambers at controlled temperature, humidity and light. Photos will be taken each day for 5 days and viability and vigor parameters will be determined by image analysis using the GERMINATOR software. Also, seed viability and seed vigor parameters will be measured by standard tests.

Tocopherol and tocotrienol content in seed rice will be measured by HPLC-MS.

Alleles variations will be determined by PCR.

Prospective tasks of the intern

- Seed preparation and maintenance during longevity tests.
- Assessment of longevity tests parameters (viability and vigor) by image analysis and by standard tests.
- Quantification of tocopherols and tocotrienols of the rice seeds by UHPLC-MS.
- Identification of alleles in genes by PCR.
- Correlation statistical analysis between longevity parameters and tocopherols/tocotrienols content.

About the research group, University and Region

The Centro para Investigaciones en Granos y Semillas (CIGRAS) (Seed and Grain Research Center) is dedicated to improving the agricultural and agro-industrial sectors through its efforts in research, teaching and extension in the areas of: postharvest technology of seeds, plant breeding, biotechnology, mycotoxins, and seed and grain quality testing. CIGRAS is attached to the Vice President's Office for Research and the Institute of Agricultural Research (IIA) of the University of Costa Rica.

The University of Costa Rica (UCR), founded in 1940, is a higher education and cultural Institution made up of a community of professors, students and administrative staff, dedicated to Teaching, Research, Social action, Study, Meditation, Artistic creation and the Dissemination of knowledge. UCR is placed in the global ranking of QS universities for 2022 in the range of 531- 540, a rating that places it in 24th place among all Latin American universities and first in Central America and Costa Rica.