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Assessment of OTA Contamination in Rice from Fungal Growth Alterations in a Scenario of Climate Changes

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Abstract : Rice (Oryza sativa) production plays a vital role in reducing hunger and poverty and assumes particular importance in low-income and developing countries. Rice is a sensitive plant, and production occurs strictly where suitable temperature and water conditions are found. Climatic changes are likely to affect worldwide, and some models have predicted increased temperatures, variations in atmospheric CO_2 concentrations and modification in precipitation patterns. Therefore, the ongoing climatic changes threaten rice production by increasing biotic and abiotic stress factors, and crops will grow in different environmental conditions in the following years. Around the world, the effects will be regional and can be detrimental or advantageous depending on the region. Mediterranean zones have been identified as possible hot spots, where dramatic temperature changes, modifications of CO_2 levels, and rainfall patterns are predicted. The actual estimated atmospheric CO_2 concentration is around 400 ppm, and it is predicted that it can reach up to 1000–1200 ppm, which can lead to a temperature increase of 2–4 °C. Alongside, rainfall patterns are also expected to change, with more extreme wet/dry episodes taking place. As a result, it could increase the migration of pathogens, and a shift in the occurrence of mycotoxins, concerning their types and concentrations, is expected. Mycotoxigenic spoilage fungi can colonize the crops and be present in all rice food chain supplies, especially Penicillium species, mainly resulting in ochratoxin A (OTA) contamination. In this scenario, the objectives of the present study are evaluating the effect of temperature (20 vs. 25 °C), CO_2 (400 vs. 1000 ppm), and water stress (0.93 vs 0.95 water activity) on growth and OTA production by a Penicillium nordicum strain in vitro on rice-based media and when colonizing layers of raw rice. Results demonstrate the effect of temperature, CO_2 and drought on the OTA production in a rice-based environment, thus contributing to the development of mycotoxins predictive models in climate change scenarios. As a result, improving mycotoxins' surveillance and monitoring systems, whose occurrence can be more frequent due to climatic changes, seems relevant and necessary. The development of prediction models for hazard contaminants presents in foods highly sensitive to climatic changes, such as mycotoxins, in the highly probable new agricultural scenarios is of paramount importance.

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