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RADIATION-INDUCED MICRONUCLEI IN ONION (*Allium cepa*) CELLS AS A SUPPORT SYSTEM FOR ENVIRONMENTAL DOSIMETRY

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Introduction: Biodosimetry is an essential aspect of radiation protection mainly after events involving the release of radioactivity levels into the environment. Recently, the International Commission on Radiological Protection recognized the need to provide more quantitative guidance on environmental radiation protection. For this purpose, radiological impact assessment for flora and fauna requires adequate dosimetric data [1]. As a non-human biota option, higher plants are a system of choice because, in addition to providing a first screening for environmental genotoxicity, they avoid the use of animal models for testing. The onion (*Allium cepa*) is commonly used to assess genotoxicity for a wide variety of chemical and physical factors, as it allows for estimates of possible DNA damage in eukaryotes in general, including humans [2]. Its chemical composition is essentially aqueous, which makes these vegetable biota an equivalent tissue *in vivo* suitable for dosimetry. In this work, onion seedlings were exposed to low and intermediate doses of α and β radiation. Our objective was to verify if is possible to use micronuclei analysis of irradiated onion cells as a support system for environmental dosimetry. By differentiating the effects caused by different dose levels or types of radiation, it would be possible to use *Allium cepa* as a cytogenetic dosimeter both to monitor the environment radiation level and to investigate the dose received by people in environments where a radiological emergency has occurred.

Material and method: Onion seeds were cultivated in Petri dishes without exposure to any radiation source, except the background radiation levels, until the roots grew approximately 5 mm in length. Subsequently, onion seedlings were irradiated with sources of ^{241}Am and ^{90}Sr/^{90}Y, which emit α and β particles, respectively. The dose rate of both radiation sources was calculed by Monte Carlo simulation using water-equivalent tissue. Cylinders 5 mm long and 400 µm thick were used to simulate the seedlings of *Allium cepa*. The dose rate of α-partcicles and β-particles was 7.92 mGy.min^{-1} and 63.10 mGy.min^{-1}, respectively. In addition to an unirradiated control group, five dose points were evaluated for each type of radiation. Micronuclei frequency was analysed as a radiation-induced endpoint.

Results: As a result, it was observed that an increase in micronuclei frequency occurred proportionally to the increase in the dose. Dose-response curves for micronuclei frequencies induced by α and β radiation were plotted and compared (Figure 1). Alpha radiation was three to five times more effective than beta radiation in inducing the same level of micronuclei in onion cells.

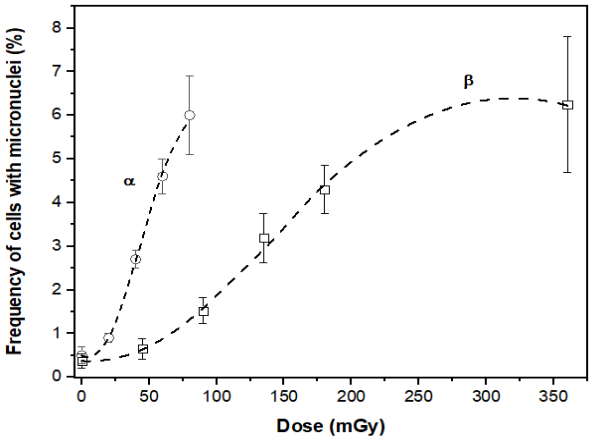

Figure 1: Dose-response curves for micronuclei induced in onion seedlings cells by α and β radiation.

Conclusions: Our research shows the potential of micronuclei analysis in onion (*Allium cepa*) cells as a sensitive support system for dosimetry, detection, and screening of cellular effects produced by low and intermediated doses of different types of radiation.

References:

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2. D. M. Leme and M. A. Marin-Morales, *Mutat. Res.* **682**(1), 71-81 (2009).