# ISM Conference 2011

# "Strategies to reduce the impact of mycotoxins in Latin America in a global context"

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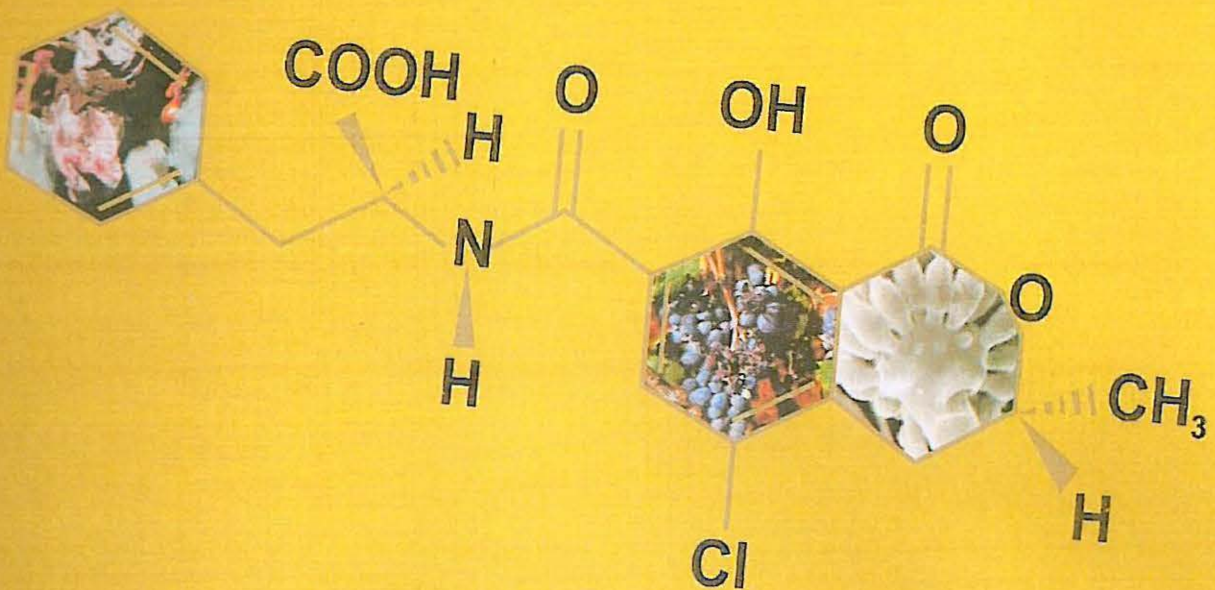
# Book of Abstracts

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## Effect of γ-radiation in the Survival of *Aspergillus parasiticus* in Chestnuts

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### Abstract

*Castanea sativa* produces the European chestnuts, also known as sweet chestnuts. *C. sativa* is adapted to regions with humid and temperate to cold climate, and does not withstand long hot and dry periods. Chestnuts are a seasonal product, being Portugal the fourth country in terms of worldwide chestnut production. After harvest and during storage, problems with deterioration may arise, mainly by plagues or microorganisms, such as the development of fungi. Fewer studies have been devoted to determining fungal contamination of chestnuts from the main producing countries (Turkey, Bolivia, Italy and Portugal). In fact, most of those studies are relative to marketed chestnuts with unknown origin. Reports on chestnuts marketed (origin not reported) in cold and humid countries, like Canada and Switzerland refer to contaminations strongly dominated by *Penicillium* spp., with *Aspergillus* spp. being of no significance, while studies from drier and warmer regions, like Georgia, USA and Ar'Ar, Saudi Arabia, report important incidences of *Aspergillus* (sections *Wentii*, *Flavi* and, to a lesser extent, *Nigri*) [1].

Currently, the safety of the chestnuts chain is based on good manufacturing practices. One of the few processing steps in this industry is the washing of chestnuts in hot water. After washing and before commercialization, a chemical treatment by fumigation with methyl bromide is required. However, recently, this treatment was banned from European Union. The hot water treatment may not be enough to guarantee the safety of chestnuts and, as a side effect, a detrimental effect on some quality traits may be observed. So, an alternative for safe processing of chestnuts is needed.

The irradiation is one promising alternative for chestnuts treatment. This method is more environmental friendly and could be more effective in microorganisms destruction; however, studies that confirm the efficacy of irradiation (both in terms of safety and of sensorial traits) are needed. In this study, the use of irradiation with γ-rays as an inactivation agent against one of the most ubiquitous and mycotoxigenic fungi – *Aspergillus parasiticus* – was studied.

Inactivation of filamentous fungi was evaluated by exposing chestnuts to known levels of γ-rays (0.25 kGγ; 0.5 kGγ; 3.0 kGγ and 10.0 kGγ). Chestnuts were previously inoculated with a spore suspension of one strain of *A. parasiticus.* After irradiation, chestnuts were washed with peptone (0.1%), being the washing solution spread in MEA10 and DG18 plates for yeasts, filamentous fungi and *A. parasiticus* counting. The growth of colonies was observed after 4 days.

In general, the higher the level of irradiation the lower the survival rate. Regarding yeast, at the two lower irradiation levels, no effect on the yeast load was observed, while a slight decrease was observed at 3.0 kGγ and no growth observed at 10.0 kGγ. For filamentous fungi (and particularly for *A. parasiticus*) a similar trend was observed, although a not significant higher resistance of filamentous fungi (including *A. parasiticus*) to irradiation was observed.

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## Reference

1. RODRIGUES, P. *Mycobiota and aflatoxigenic profile of Portuguese almonds and chestnuts from production to commercialisation*, PhD Thesis, Universidade do Minho, 2011.

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## Introduction

*Castanea sativa* produces the European chestnuts, also known as sweet chestnuts. *C. sativa* is adapted to regions with humid and temperate to cold climate, and does not withstand long hot and dry periods. Chestnuts are a seasonal product, being Portugal the fourth country in terms of worldwide chestnut production. After harvest and during storage, problems with deterioration may arise, mainly by plagues or microorganisms, such as development of fungi.

Figure 1 – The European chestnuts.

Fewer studies have been devoted to determining fungal contamination of chestnuts from the main producing countries (Turkey, Bolivia, Italy and Portugal). In fact, most of those studies are relative to marketed chestnuts with unknown origin. Reports on chestnuts marketed (origin not reported) in cold and humid countries, like Canada and Switzerland refer to contaminations strongly dominated by *Penicillium spp.*, with *Aspergillus spp*. being of no significance, while studies from drier and warmer regions, like Georgia, USA and Ar'Ar, Saudi Arabia, report important incidences of *Aspergillus* (sections *Wentii*, *Flavi* and, to a lesser extent, *Nigri*) [1].

Currently, the safety of the chestnuts chain is based on good manufacturing practices. One of the few processing steps in this industry is the washing of chestnuts in hot water. After washing and before commercialization, a chemical treatment by fumigation with methyl bromide was required. However, recently, this treatment was banned from European Union. The hot water treatment may not be enough to guarantee the safety of chestnuts and, as a side effect, a detrimental effect on some quality traits may be observed. So, an alternative for safe processing of chestnuts is needed.

The irradiation is one promising alternative for chestnuts treatment. This method is more environmental friendly and could be more effective in microorganisms destruction; however, studies that confirm the efficacy of irradiation (both in terms of safety and of sensorial traits) are needed.

## Objective

The aim of this study was to evaluate the use of irradiation with γ-rays as an inactivation agent against natural mycoflora, and one of the most ubiquitous and mycotoxigenic fungi – *Aspergillus parasiticus*.

## Materials and Methods

Inactivation of fungi was evaluated by exposing chestnuts to known levels of γ-rays (0.25 kGy; 0.5 kGy; 3.0 kGy and 10.0 kGy). Chestnuts were previously inoculated with a spore suspension of one strain of *A. parasiticus*. After irradiation, chestnuts were washed with peptone (0.1%), being the washing solution spread in MEA10 and DG18 plates for yeasts, filamentous fungi and *A. parasiticus* counting. The growth of colonies was monitored during 4 days.

## Results and discussion

In general, the higher the level of irradiation the lower the survival rate. At 0.25 kGy no decreasing growth was observed: the colonies observed were similar to the control colonies (no irradiation).

Regarding yeast, at the two lower irradiation levels, no effect on the yeast load was observed, while a slight decrease was observed at 3.0 kGy and no grow observed at 10.0 kGy. For filamentous fungi (and particularly for *A. parasiticus*) a similar trend was observed, although a not significant higher resistance of filamentous fungi (including *A. parasiticus*) to irradiation was detected.

The irradiation effect can be directly verified in chestnuts. It is possible to detect differences between the irradiated chestnuts with different irradiation levels, within days after irradiation. In Figure 2, it is possible to see the colony growth in chestnuts irradiated with 0.25 kGy and, in Figure 3 no colonies were observed in chestnuts irradiated with 10.0 kGy.

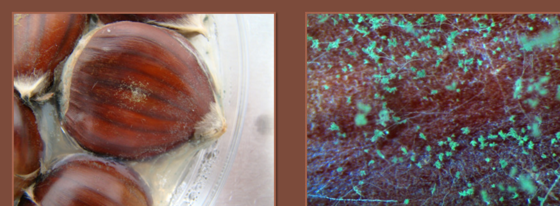

Figure 2 - Chestnuts irradiated with 0.25 kGy.

Figure 3 - Chestnuts irradiated with 10.0 kGy.

## Conclusions

- Yeast and filamentous fungi are equally sensitive to resistance to γ-radiation.
- For irradiation levels above 3.0 kGy, the survival of fungi decreased significantly.

## Acknowledgements

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## References

[1] RODRIGUES, P.. Mycobiota and aflatoxigenic profile of Portuguese almonds and chestnuts from procuction to commercialisation, PhD Thesis, Universidade do Minho, 2011.