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An electromagnetic-thermal model for heating patterns prediction of microwave treated palm to contrast the Red Palm Weevil

Rita Massa[1], Gaetano Panariello[2], Daniele Pinchera[2], Fulvio Schettino[2], Marco D Migliore[2], Emilio Caprio[1] and **Raffaele Griffo[1]**
[1]University Naples Federico II, Italy
[2]University of Cassino and Southern Lazio, Italy

The invasive red palm weevil (RPW), *Rhynchophorus ferrugineus* Olivier is one of the most destructive pests of palms in the world. In the Mediterranean Basin, it spread slowly until 2004 but nowadays it can be found in almost all Mediterranean countries and it is particularly destructive for *Phoenix canariensis* palms. In the integrated pest management strategy, adopted to combat this pest, there is a considerable interest toward solutions able to control the pest with a minimum impact on the environment. Microwave/dielectric heating (MDH) is a technology that could meet this requirement by increasing the temperature of the insect until it dies, or its development capability is reduced, without damage the palm tissues. MDH is applied to insect control in food and we have shown its feasibility on infested palms. Heating patterns strongly depend on both electromagnetic and thermal properties that are related to the physiology of the plant. Results of dielectric spectroscopy and calorimetric measurements, carried out during microwave exposure of a healthy living palm, were employed to develop a simple electromagnetic-thermal code. It allows to predict the thickness of the annular area in "living" palms wherein the temperature reaches the lethal temperature for the insect, and how long it should stay in order to have a high probability that the treatment is successful without damaging the palm core that is the most relevant area for the life of the palm itself. The heating patterns predicted were found to agree well with the experimental and numerical results (obtained with commercial software). It can be concluded that, MDH is a very promising and eco-compatible solution for contrasting the diffusion of RPW. The tool developed can be easily used by non-skilled operators for setting the parameters that can better guarantee the efficacy of the treatment.

Biography

Rita Massa is a Professor of Electromagnetic Fields in the Department of Physics "Ettore Pancini" at the University of Naples Federico II, where she is the chief of the NIR-Billy (Non Ionizing Radiation-Biolectromagnetic) Laboratory. She has her expertise in the interactions of electromagnetic fields (overall radiofrequency and microwaves) with materials. Her research interests are biological effects of electromagnetic fields, electromagnetic dosimetry, electromagnetic fields exposure assessment (both numerical and experimental), therapeutic and industrial applications of microwaves, high power microwave applications, nondestructive testing of materials. The approach is basically experimental. The purpose applications focused on human health (biological systems) and monitoring (diagnostics) and control of materials and processes.

massa@unina.it

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