

## ABSTRACT

In the frame of the project, there were continued during 2016 researches referring to multifunctional partially finalized in the previous year 2015, as following:

- A functional model as a multifunctional product based on a consortium of microscopic fungi from the genus *Trichoderma*, with biostimulant action, with a balanced inducing of different defence ways, supported by the secondary metabolites and bioactive compounds/phytonutrients activity for the cultivated plants, especially the nutraceuticals ones, has been obtained. Strains of *Trichoderma harzianum* Td50b and *T. asperellum* T36b have been characterized from different points of view: taxonomic, cultural, morphological, physiological, physical and biological activity against various phytopathogens and conditioning of product. These isolates have been stored at the National Collection of Agricultural and Industrial Microorganisms, Budapest, Hungary, under the code names NCAIM (P) F 001412 and NCAIM (P) F 001434, respectively.

- Through the performed researches on the characteristics of ceramic materials, it has been achieved a multifunctional product based on the porous ceramics (finalized), with biostimulant effect of inducing the balanced defence mechanisms at plants, which could be used as a conditioning support for the *Trichoderma* consortia, too.

- The carried out studies in the frame of this project have allowed to be obtained an omogene and stable aqueous dispersion containing mesoporous silica particles, stabilized by the oleic acid – Na oleate, synthesized starting from the Na silicate and 3-aminopropyltriethoxysilan, with the ability to encapsulate an essential oil. These researches have managed to achieve a third multifunctional product based on mesoporous silica and essential oils, savory (*Satureja hortensis*) oil, respectively.

All multifunctional products achieved in the frame of the project, based on *Trichoderma* consortia, on porous ceramics with nutrients, on mesoporous silica and essential oils, have been tested in the experimental field of *Momordica charantia* plants, at SC Hofigal Import Export SRL Romania, under the crop conditions maintained in conformity with the good agricultural practice. Based on the obtained field results, it has been established an evaluation scale for the multifunctional preparates depending on the morpho-physiological parameters: leaf area/surface, photosynthesis (chlorophyll florescence), stomatal conductance, fruit yield and the values of bioactive antioxydative compounds analyzed by different methods.

It has been obtained the alternative functional model of *in vitro* tests for determining biological activity from *M. charantia* plants treated with multifunctional products. These tests have consisted in the antioxydative capacity/ability of *M. charantia* plant extracts, respectively, determination of cell viability (proliferation capacity, cell morphology of treated cells in comparison with the normal one, citotoxic effect correlated with investigated values), by the method with neutral red coloration and the cell morphology by optic microscopy after Giemsa coloration. It has been evaluated citotoxic effect of *M. charantia* plant extracts by testing of different concentrations for each extract (50, 100, 150 µg/ml) using clone 929 of the stabilized cell line NCTC of conjunctive tissue from mouses and by cantitative (spectrophotometer method) and qualitative (optic microscopy) tests. *M. charantia* plant extracts influence on the morphology of NCTC cells has been varied in conformity with the extract concentration. Values between 50 and 150 µg/ml have not produced important modifications in cell morphology and cell density, too. At these values, cells have presented normal aspect, with 2-3 extensions, fine monochrome cytoplasm, and very little rounded cells. The conclusions of these tests have revealed that *M. charantia* plants treated with multifunctional products have presented a significant antioxydative effect, especially in the variant with *Satureja hortensis* oil treatment (V4A, V4B) and *Trichoderma* Blackjak fertilizer applied on the

soil, analyzed plants showing the highest content of flavonoids and polyphenols and the best antioxidative activity in comparison with the other variants included in our experiment, V6, and V1-V3, respectively. Using the test with neutral red (RN) in the cell cultures, it has been demonstrated that the variant V4A / treatment with *S. hortensis* essential oil, has presented biocompatibility on the normal fibroblasts culture L929, and the antiproliferative effect on the tumoral cell culture HEP-2, too.

Our research results have been disseminated during the year 2016 by participation with papers at 11 scientific international and national scientific events with international participation (congresses, conferences, symposia, meetings, workshops, etc.).

There were published 5 scientific articles in the following ISI indexed journals: *Nanomaterials* (IF = 3,176, <http://www.mdpi.com/journal/nanomaterials>), *Revista de Chimie* (IF = 0.810, [www.revistadechimie.ro](http://www.revistadechimie.ro)), *Acta Scientiarum Polonorum. Hortorum Cultus* (IF = 0.599, <http://www.acta.media.pl>).

A number of 2 scientific articles have been sent for publishing in different journals: *Materials* (ISI indexed, IF = 3,399, <http://www.mdpi.com/journal/materials>), and *Journal of Plant Development* (IDB indexed, <http://www.plant-journal.uaic.ro/home.htm>).

As a novelty for this research year, there were been prepared for publishing 6 chapters for the book „*Trichoderma spp. – applications in agriculture and horticulture*”, included in the editorial content of Publishing House of the University Bucharest in 2017. This material is the result of the organized symposium on the same subject, held in 2016 at ICECHIM with international participation.