GHENT UNIVERSITY

FACULTY OF BIOSCIENCE ENGINEERING

ABSTRACTS

69th International Symposium on Crop Protection

May 23, 2017
Ghent
Belgium

GHENT UNIVERSITY
Faculty of Bioscience Engineering
Coupure links 653
BE-9000 Ghent (Belgium)

Session 4
Phytopathology I
12:20

DEVELOPMENT AND ASSESSMENT OF PLANT PROTEIN HYDROLYSATES AS BIOPESTICIDES AGAINST ZUCCHINI POWDERY MILDEW

M. CAPPELLETTI[1,2], M. PERAZZOLLI[1], A. NESLER[1,3], O. GIOVANNINI[1] & I. PERTOT[1]

[1] Department of Sustainable Ecosystems and Bioresources, Research and Innovation Centre, Fondazione Edmund Mach, IT-38010 San Michele all'Adige, Italy
[2] DI4A, Department of Agrifood, Environmental and Animal Sciences University of Udine, IT-33100 Udine, Italy
[3] Bi-PA - Biological Products for Agriculture Technologielaan 7 Londerzeel BE-1840, Belgium

Several chemical pesticides may negatively affect human health and the environment, and their substitution is a priority in agriculture. Biological control by protein hydrolysates may offer a sustainable solution, making plants more resilient to biotic and abiotic stress. Protein hydrolysates are a wide category of compounds, and their functional properties are affected by the protein source, the hydrolysis method and the degree of hydrolysis (percentage of cleaved peptide bonds). A protein extract (Nutrient Broth) showed high efficacy in controlling zucchini powdery mildew, and reduced grapevine powdery and downy mildew severity by activating the expression of defense-related genes, suggesting the stimulation of plant resistance mechanisms. In the present work, we selected zucchini and powdery mildew as study pathosystem, given the high relevance of the disease (caused by *Podosphaera xanthii*), and the lack of commercially relevant resistant cultivars. The goal of our work was to optimize a protocol to produce plant protein hydrolysates, by selecting the most active protein source (soybean, rapeseed and guar protein meals) and the hydrolysis method (acid or enzymatic hydrolysis). The efficacy against the disease of the different hydrolysates was tested on zucchini plants under greenhouse conditions (24 °C, 80% relative humidity). The enzymatic hydrolysates were produced using Alcalase or Flavourzyme at two different enzyme/substrate ratios (1 and 50% of enzyme units per gram of protein content) for 24 h at 50 °C. The acid hydrolysates were obtained using 6N H_2SO_4 for 15 min at 121 °C (condition A) or for 8 h at 100 °C (condition B). In addition, the direct effect of protein hydrolysates on the germination of conidia of *P. xanthii* was assessed, in order to better characterize the mechanism of action. Under greenhouse conditions, preventive foliar treatments with guar hydrolysates produced with both alcalase 50% and with H_2SO_4 at condition B showed the highest efficacy against powdery mildew compared to the non-hydrolysed protein source. Conversely, applications of soybean and rapeseed enzymatic and acid hydrolysates demonstrated an efficacy comparable to the non-hydrolysed product. A positive correlation was found between efficacy and hydrolysis degree values of guar acid hydrolysate, suggesting that this hydrolysis method may enhance the functional properties of the original protein source. Free amino acids and peptides composition of hydrolysed and non-hydrolysed samples could explain the different levels of biocontrol activity. In conclusion, the guar protein meal processed with the two methods produced bioactive mixtures with satisfactory effect against zucchini powdery mildew; however further research is required to fully clarify the mechanisms of action and upscale the process. Increasing crop resilience to diseases by the application of low-cost protein hydrolysates may bring considerable benefits from environmental and economic points of view.

Key words: Plant hydrolysates, Proteolytic enzymes, Biocontrol activity, *Podosphaera xanthii*, Cucurbitaceae