Bio-based composite of chitosan, gallic acid, cellulose nano-crystals and high amylose starch as organic control strategy of *Fusarium* spp. diseases in wheat and as biostimulant on plants

Sara FRANCESCONI - *University of Tuscia*

Fusarium are cosmopolitan fungal pathogens for wheat, causing Fusarium head blight (FHB) and crown rot (CR). *Fusarium* diseases are managed by the application of synthetic fungicides showing negative or unknown side effects on the environment. Thus, there is an urgent need to find novel, efficient and bio-based solutions to mitigate plant diseases. Nanotechnology-based agrochemicals are promising, since cellulose nano-crystals (CNCs) can be obtained by plant wastes and employed as green nano-carriers to deliver active molecules. High-amylose starch (HAS) consisting of a high content of amylose, can act as excipient by increasing the solubility of active compounds. We extracted CNCs and HAS from wastes of the bread wheat genotype Cadenza high-amylose obtained by Targeting Induced Local Lesions IN Genomes (TILLING) and characterized by mutations in the *starch branching enzyme IIa* (*SBEIIa*) gene, thus accumulating high-amylose starch. Chitosan and gallic acid were assayed as active molecules. *In vitro* experiments individuated the optimal active concentration in order to formulate a bio-based composite of CNCs, HAS, chitosan (25% w/w), and gallic acid (2.5% w/w). The bio-based composite (tested in vivo at 2%) displayed biostimulant properties by enhancing the % of seed germination, the Nitrogen Balance Index (NBI) values and the dry biomass of wheat plantlets. Artificial inoculation of *Fusarium culmorum* (causing CR) and *Fusarium graminearum* (causing FHB) after a pre-treatment of the bio-composite drastically reduced the symptomatic progression of *Fusarium* diseases, compared to conventional fungicide (tebuconazole). Furthermore, the accumulated fungal biomass and mycotoxins into the infected tissues as much as the grain yield will be evaluated to further validate the effect of such bio-based composite on disease management. Further research will be focused on analyzing the gene expression of several disease resistance responsive genes in relationship to the application of the bio-based composite