International Conference
FROM SEED TO PASTA III
A Sustainable Durum Wheat Chain for Food Security and Healthy Lives
Bologna - Italy, 19-21 September 2018

DEOXYNIVALENOL DETOXIFICATION IN TRANSGENIC DURUM WHEAT CONFERS RESISTANCE TO FUSARIUM HEAD BLIGHT AND CROWN ROT DISEASES REDUCING GRAIN MYCOTOXIN CONTAMINATION

Giulia Mandalà, Silvio Tundo*, Sara Francesconi, Federica Gevi, Lello Zolla, Carla Ceoloni, Renato D'Ovidio

Department of Agricultural and Forest Sciences (DAFNE), University of Tuscia, Viterbo, Italy
** Present address: Department of Land, Environment, Agriculture and Forestry (TeSAF), Research Group in Plant Pathology, University of Padova, Legnaro (Padova), Italy*

Fusarium diseases, including Fusarium head blight (FHB) and crown rot (FCR), represent major agricultural problems worldwide, causing reduction of grain yield, quality and food safety. Grain contamination by Fusarium mycotoxins, mainly deoxynivalenol (DON), is responsible for health problems in humans and animals. DON acts as virulence factor during pathogenesis and its glycosylation, performed by UDPglucosyltransferases (UGTs) and resulting in DON-3-glucoside (D3G) production, has been identified as the main detoxification strategy in wheat. In this work, we produced Triticum durum cv. Svevo transgenic lines constitutively expressing the barley HvUGT13248 gene. In them, DON-detoxification by UGT was found to confer a broad-spectrum resistance against F. graminearum and F. culmorum, affecting different plant organs and developmental stages during FHB and FCR. When challenged with F. graminearum, the transgenic plants revealed a significant reduction (up to 30%) of FHB symptoms, mostly evident during early-mid stages of the infection progress. Notably, much higher DON-to-D3G conversion ability and considerable decrease of DON and DON+D3G content in wholemeal flour of transgenic lines vs. nontransgenic control was observed. The higher efficiency of D3G conversion since early infection stages may have reduced fungal progression and, consequently, DON and D3G contamination in kernels. Furthermore, we highlighted for the first time the possible involvement of the DON-detoxifying mechanism in limiting FCR disease caused by F. culmorum. When challenged with the pathogen at the seedling stage, the HvUGT13248-expressing lines showed significant reduction (~50%) of FCR symptoms throughout the infection as compared to non-transgenic plants. Transgenic seedlings revealed also a better root tolerance to DON, which could have contributed to a higher seedling vigor during the infection. The concomitant efficacy of the DON-detoxification strategy against FHB and FCR represents an attracting sustainable approach to pursue in breeding programs targeting broad-spectrum Fusarium resistance and hence reduction of mycotoxin contamination of durum wheat-derived products.