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Bilateral collaboration Italy-Canada for maize Fusarium resistance in the Canadair project*

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Within the framework of the CANADAIR project, a bilateral collaboration between CRA-MAC (Maize Research Unit of Bergamo-Italy) and ECORC (Agri-Food Canada, Eastern Cereal and Oilseed Research Centre-Ottawa), will allow achieving a complementation and integration of transcriptome data, and the genes that are regulated during maize response both to *Fusarium graminearum* and *Fusarium verticillioides* will be identified. Commonly regulated genes could act as functional markers of resistance in both diseases. The tests performed on maize lines will allow the identification of genetic materials with affordable resistance to both pathogens.

CRA-MAC, recently focused its research activity on the identification of genetic and molecular bases of maize resistance to *F. verticillioides* through i) artificial inoculation screening of genotypes from breeding programs using the KIA (Kernel Inoculation Assay) on sib crossed plants and ii) implementation of differentially gene expression through a RNAseq experiment.

From previous studies (Balconi *et al*., Phytop. Medit. 53 (1) 14-26, 2014) four Italian inbred lines showed differential patterns of susceptibility (Lo 43, Lo 186) or resistance (Lo 18, Lo 435) to *F. verticillioides*. These materials have been used in transcriptome analyses (Table1).

The ECORC research Group of Linda Harris is involved in the investigation of transcriptional changes taking place during maize/ *F. graminearum* interaction. The Canadian group carried out transcriptional analyses of resistant and susceptible maize genotypes, analysing changes in kernel tissues. In addition, the ECORC group has developed a recombinant inbred line (RIL) population (F6) of >400 lines derived from CO441 (resistant) x B73 (susceptible), segregating for resistance to *F. graminearum*. Four RIL lines (RIL 19,RIL 77, RIL 226 resistant and RIL 278 susceptible to *F. graminearum*) have been used in transcriptome analyses (Table 1).

The collaboration implied the exchange of materials and data during 2012-2014 period. RNAseq results will be shared in order to highlight the most repeatable and therefore affordable data. During 2012 and 2013 seasons, the most *F. verticillioides* resistant and susceptible lines identified by CRA-

MAC were tested for *F. graminearum* resistance by the ECORC group; similarly, the most resistant and susceptible RILs identified by ECORC were provided to CRA-MAC and tested through field artificial inoculation for resistance to *F. verticillioides.*

At 15 DAP (Days After Pollination) the different materials have been inoculated with a mix of two toxigenic *F. verticillioides* strains (10^6 spores/ml) with a multi inoculation assay on sib crossed plants (Figure 1A). At 1 and 5 DAI (Days After Inoculation) 4 ears/treatment as biological replicates (non-inoculated, sterile water as internal control and Fusarium) were harvested for molecular analyses (data not shown).

For phenotyping at 15 DAP the same materials have been inoculated with the same concentration of spores with a single inoculation assay (Figure 1B). At harvest time different parameters such as visual rating score (Reid *et al*., Technical Bull. 1996-5E, 1996), Number of Infected Kernels at the inoculation point (NIK), percentage of internal infected kernels on DRBC (King *et al*., App. and Environ. Microbiol. 37, 959-964, 1979) and fumonisin content, were evaluated.

More in detail, the extension of the mycelium during 2013 season, as Number of Infected Kernels at the inoculation point (NIK), is lower than 10 for resistant, and between10 and 20 for susceptible genotypes respectively. Under artificial inoculation, the fumonisin content ranged from 90000 to 200000 µg/K for susceptible materials and < 30000 µg/Kg for resistant genotypes. Preliminary data suggest that Canadian materials selected for resistance/susceptibility to *F. graminearum* maintained the same trend also under *F. verticilliodes* inoculation.

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Table 1: Maize genotypes under study

CRA-MAC Italy	
Lo 18	most resistant to *F. verticillioides*
Lo 43	most resistant to *F. verticillioides*
Lo 186	most susceptible to *F. verticillioides*
Lo 435	most susceptible to *F. verticillioides*
AAFC-ECORC Canada	
RIL 19	most resistant to *F. graminearum*
RIL 77	most resistant to *F. graminearum*
RIL 226	most resistant to *F. graminearum*
RIL 278	most susceptible to *F. graminearum*

Figure 1: Different inoculation assays

A
Multi Inoculation-Molecular analyses

B
Single Inoculation-Phenotyping