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Ascospore production, dispersal and survival in *Fusarium graminearum*

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Abstract

Fusarium graminearum is the most important species in the fungal complex causing Fusarium head blight (FHB) of small grain cereals. The fungus produces two types of spores on crop residues, ascospores and conidia, which are dispersed to ears by air currents and rain splashes, respectively. Ascospores are produced and mature in perithecia on crop residues, they are then forcibly discharged and become airborne. The effects of temperature (T) and relative humidity (RH) on perithecium production and maturation and on ascospore production on maize stalk residues were investigated. T and RH thresholds were identified for perithecia production and maturation, and dynamics of inoculum production as response to these variables were studied.

Weather variables also affect the moisture of previous crop residues in field, that are the substrate for overwintering and inoculum production of *F. graminearum* and other fungi. The relationship between weather variables and residues (maize stalks) moisture was then addressed, and a simple, weather-driven model developed.

Ascospore release in response to weather variables was then assessed, both through experiments in controlled conditions and outdoor. The effect of T on ascospore discharge was studied *in vitro*. Rain (R) and vapor pressure deficit (VPD) based rules were identified for conditions leading to ascospore discharge and the amount of discharged ascospores in outdoor experiments.

The distribution patterns of discharged ascospores and conidia within a wheat canopy were then assessed by using passive spore samplers. A random distribution of the ascospores within the wheat canopy and at the ear level was highlighted by the trials, together with a clear vertical distribution pattern showing an upward movement of the ascospores from the maize residues on the ground.

As discharged ascospores can deposit on wheat ears under unfavorable conditions for germination, the effect of the exposure to dry periods (DP) of different length, and of T and RH during DP on ascospores survival was studied both *in vitro* and *in planta*. Ascospore survival was described as function of DP duration, T and RH. Reduction in the fungal biomass in wheat ears in response to DP length was observed early after infection, but not at kernel maturity.

Results from this work can help refining the epidemiological models used as decision aids in FHB management programs.