Investigation of the mechanisms of sexual reproduction in Zymoseptoria tritici and their consequences on STB dynamics

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Investigation of the mechanisms of sexual reproduction in *Zymoseptoria tritici* and their consequences on STB dynamics

Zymoseptoria tritici is a relevant model to investigate the mechanisms of sexual reproduction in a pathogenic fungus and its consequences on disease epidemics. Ascospores produced on wheat debris are the main form of primary inoculum (Suffert et al., 2011) but are also largely involved at the end of growing season (Duvivier, 2015). We investigated: (1) the contribution of the ascospores to the early epidemic stages, from the build-up to the release of the primary inoculum; (2) the epidemiological determinants of the sexual reproduction, at leaf and canopy scales; (3) a possible trade-off between pathogenicity (asexual stage) and transmission (sexual stage). In a 8-year field experiment we established that the local presence of contaminated debris has a strong effect, although transient and dependant on their fungal load (year effect), on the early dynamic of Septoria tritici blotch (Suffert & Sache, 2011). The amount of primary inoculum was characterized, coupling spore trapping with qPCR (Morais et al., 2015a); the pathogenicity of ascospores and pycnidiospores was compared (Morais et al., 2015b); finally, the origin of primary inoculum was inferred from the comparison of the aggressiveness profiles of local and distant pathogen populations (Morais et al., 2016). Using an experimental crossing method (Suffert et al., in prep.), we investigated the effect of a short delay in the co-infection timing of parental isolates (beneficial to ascosporogenesis) and the effect of variations in lesion density (corroborating field observations). Field results also suggested that the site of sexual reproduction (leaves and stems) shift in autumn from basal to upper part of the entire, senescent plants of the previous year, correlatively to their co-infection timing. We have not established experimentally any adaptive compromise between the two reproduction modes of *Z. tritici* (pathogenicity and transmission). We postulate, however, and discuss the occurrence of trade-offs based on Allee effect at the plant scale. At the end of field epidemics a low pathogen density on upper leaves would decrease the likelihood of mating between compatible strains, thus limiting sexual reproduction and transmissibility of the fittest strains, whose selection is driven by seasonal thermal fluctuations (Suffert et al., 2015).