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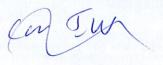https://hal.inrae.fr/hal-02791573

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Contrasted spatiotemporal dynamics of resistance and its drivers in the pathogenic fungus *Zymoseptoria tritici* in France revealed by statistical analysis

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Resistance management is a considerable issue in our modern agricultural systems, since it contributes to the broader challenge of reducing pesticides use. Yet, resistance management has to be adapted to resistance dynamics, which is still very challenging to predict since it depends upon unforeseeable and numerous biological and genetic traits of pests and on the pesticide use.

Here, we retrospectively studied the evolutions of well-described resistances occurring in *Zymoseptoria tritici* populations, toward benzimidazoles, Qols, DMIs and SDHIs fungicides. We used data from the *Performance* trial network, which compiled the frequencies of each resistant phenotype since 2004 on about 70 French locations yearly.

Using spatial, ANOVA and dynamic models based on *glm*, our statistical analysis highlighted contrasted behaviours among phenotypes such as: (*i*) specific spatial distributions; (*ii*) colonization front structures; (*iii*) large diversity of national evolution speeds; (*iv*) differential growth rates among regions. Among explanatory variables we tested to understand trends, pedo-climatic context at large scale, sowing date, wheat variety and soil type from trials were not found significant. In contrast, the influence of regional fungicide use was significant and results were coherent with laboratory knowledge about resistances.

We provided here a quantitative description of resistance evolution in space and time, for several modes of action. Moreover, we highlighted contrasted and sometimes cryptic resistance dynamics over the French territory. Then, through a first explanatory approach we found that large-scale use of fungicides seemed to be a significant driver of resistance spatio-temporal evolutions. However, further analyses are needed to refine results concerning the latter part.