Comparing the virulence of *Fusarium* strains on spring wheat

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***Fusarium graminearum* and *Fusarium culmorum* are the main pathogens that cause Fusarium head blight (FHB), the principal ear disease on cereals and maize. To control this disease, breeders develop resistant cultivars, urgently requested by farmers. For the selection of resistant genotypes, usually trials with artificial infections are set up using virulent strains of *F. graminearum* and *F. culmorum.* Often, there are important differences in disease severity between different trials and years. The underlying causes require further investigations in order to improve the appreciation of resistance. In particular, the factors affecting the virulence of *Fusarium* strains must be identified. In this study, the influence of the fungal species, the chemotype, the plant of origin of the strains (wheat or maize) and its interactions with cultivars resistance on the virulence of the strains are investigated.**

Species	Chemotype	Plant of origin of the strains
11 *F. culmorum*	36.3% 3A-DON 45.7% NIV 18% unknown	46% Maize 54% Wheat
7 *F. graminearum*	100% 15A-DON	43% Maize 57% Wheat
1 *F. crookwellensee*	100% NIV	100% Wheat

Table 1: Species, chemotype and plant origin (wheat or maize) of nineteen Fusarium strains used in this study.

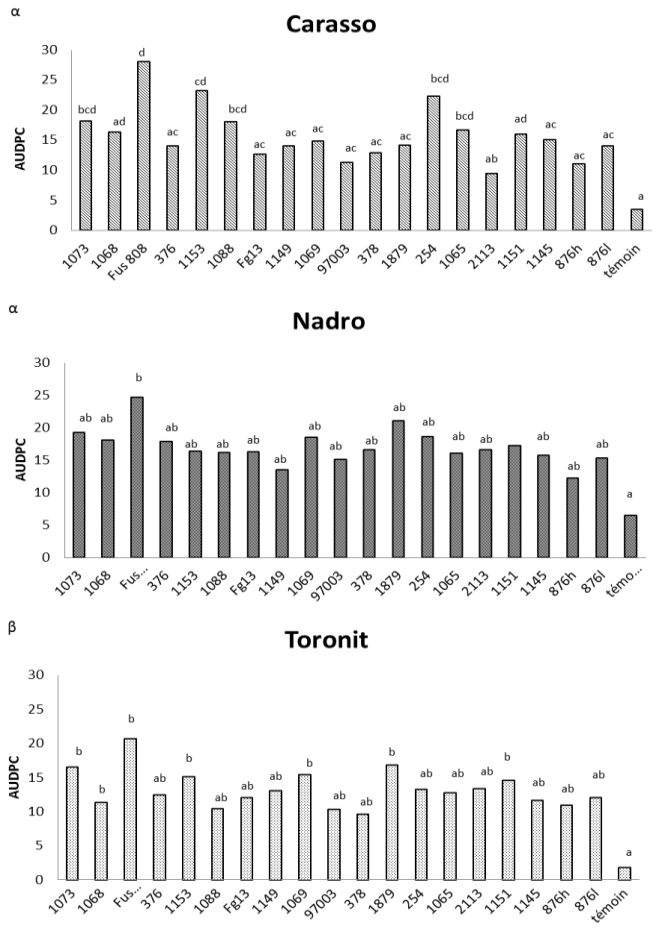

Fig 1 : Disease severity caused by nineteen strains of *Fusarium spp.* on the three spring wheat cultivars Carasso, Nadro and Toronit. Different levels of disease severity are noticed. Toronit results to be the most resistant cultivar. The strain *Fusarium culmorum* 808 shows the highest virulence on the three cultivars.

Fusarium strains show a broad diversity of virulence (fig.1) but disease severity is also influenced by varietal resistance (fig.2). Analysis of variance (ANOVA) reveals that 44% of the disease severity is due to the virulence and only 10% is explained by plant resistance. When decomposing the different virulence factors by ANOVA, the species and the chemotype seem to play a major role in the virulence of the strains (tab.2).

Fig 2 : Differences in symptoms caused by the same strain on three wheat cultivars.

Table 2 : Nested ANOVA on AUDPC to decompose the strains virulence factors. (a) using cultivars and fungal species as factors and (b) using wheat cultivar and chemotype as factors.

(a)	Df	Sum Sq	F value	Pr(>F)
species (F.g or F.c)	1	134.2	7.206	0.00827 **
cultivar	2	488.5	14.0088	<0.001***
species:strain	14	921.7	3.852	<0.001***
species:cultivar	2	14.2	0.418	0.65 ns
species:strain:cultivar	28	497.0	1.043	0.42 ns
residus	93	2093.6	--	--

(b)	Df	Sum Sq	F value	Pr(>F)
chemotype	2	275.1	8.8080	<0.001***
cultivar	2	474.9	13.949	<0.001***
chemotype:strain	13	835.9	3.508	<0.001***
chemotype:var	4	129.8	1.907	0.1 ns
chemotype:strain:var	26	381.4	0.862	0.65 ns
residus	123	3.508	--	--

Conclusion

- Differences in disease severity was mainly explained by strain virulence. The virulence was independent of the origin of the strains.
- No interactions were observed between the virulence of the strains and the cultivar resistance.
- The chemotype and the fungal species had a significant but weak effect on virulence. The chemotype 3A-DON of *F. culmorum* seems to enhance virulence.
- The absence of interactions between virulence and varietal resistance simplifies a reliable estimation of the cultivar resistance.
- Differences between trials seem to depend on GxE interactions. It will be interesting to investigate in which measure the environmental conditions influence the fungus and the plant.

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