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Effect of elevated CO_2 concentration on leaf rust resistance in a broad panel of European winter wheat varieties

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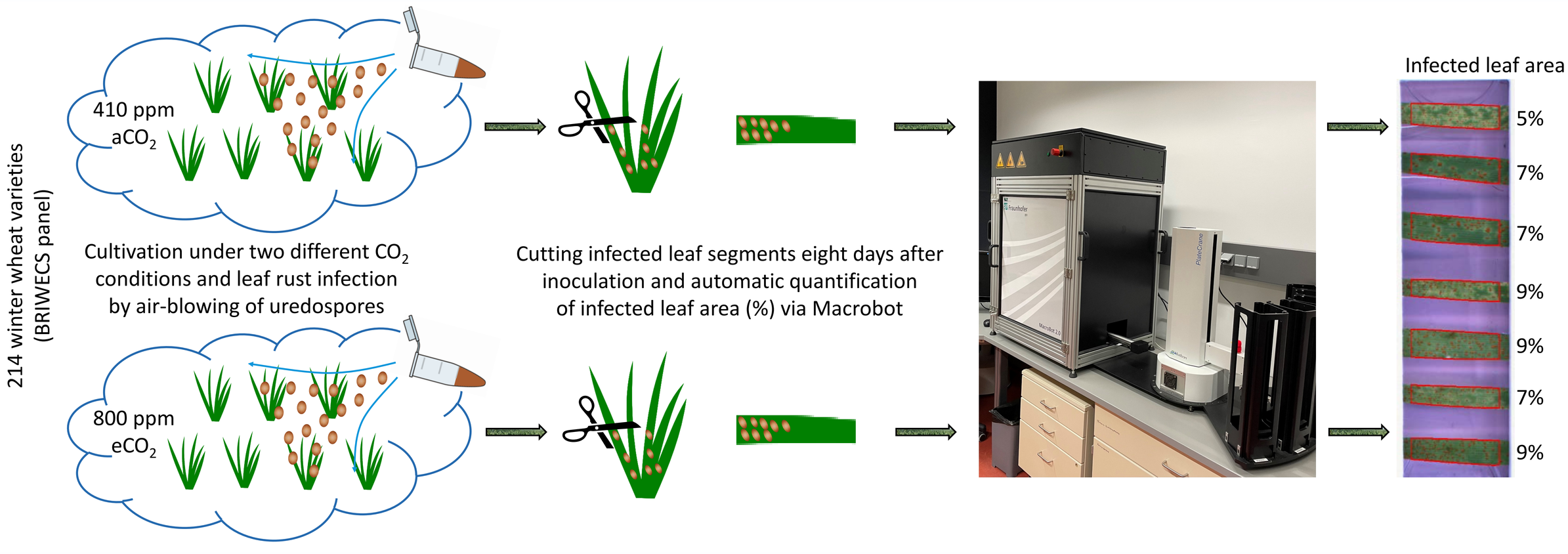
Introduction

Epidemics of leaf rust caused by *Puccinia triticina* lead to yield losses up to 60%. Breeding and cultivation of resistant varieties is the most effective and environmental friendly strategy to inhibit leaf rust infections. However, it can be assumed, that an elevated CO_2 concentration influences the infestation with leaf rust. There is limited knowledge on the effects of elevated CO_2 (eCO_2) concentration on the infection level and resistant behaviour of a large number of varieties yet. Previous studies allow the conclusion, that an increase in biomass and changes in stomata closure are to be expected and affect pathogen development. In the WheatFACE project, we strive to obtain a better understanding of eCO_2 on the leaf rust resistance behaviour of winter wheat.

Materials and Methods



Results

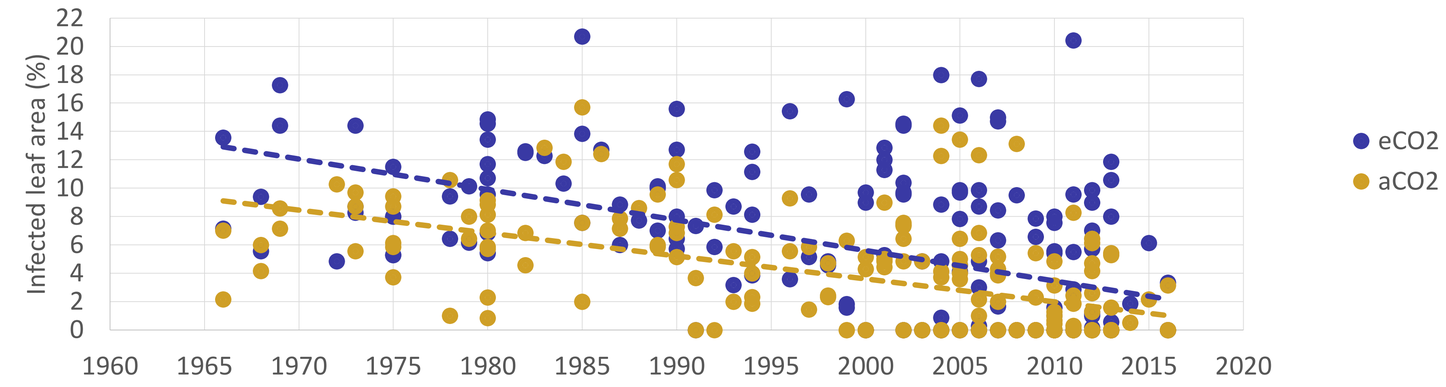


Figure 1: Leaf rust infection areas of all varieties depending on the year of release and CO_2 treatment.

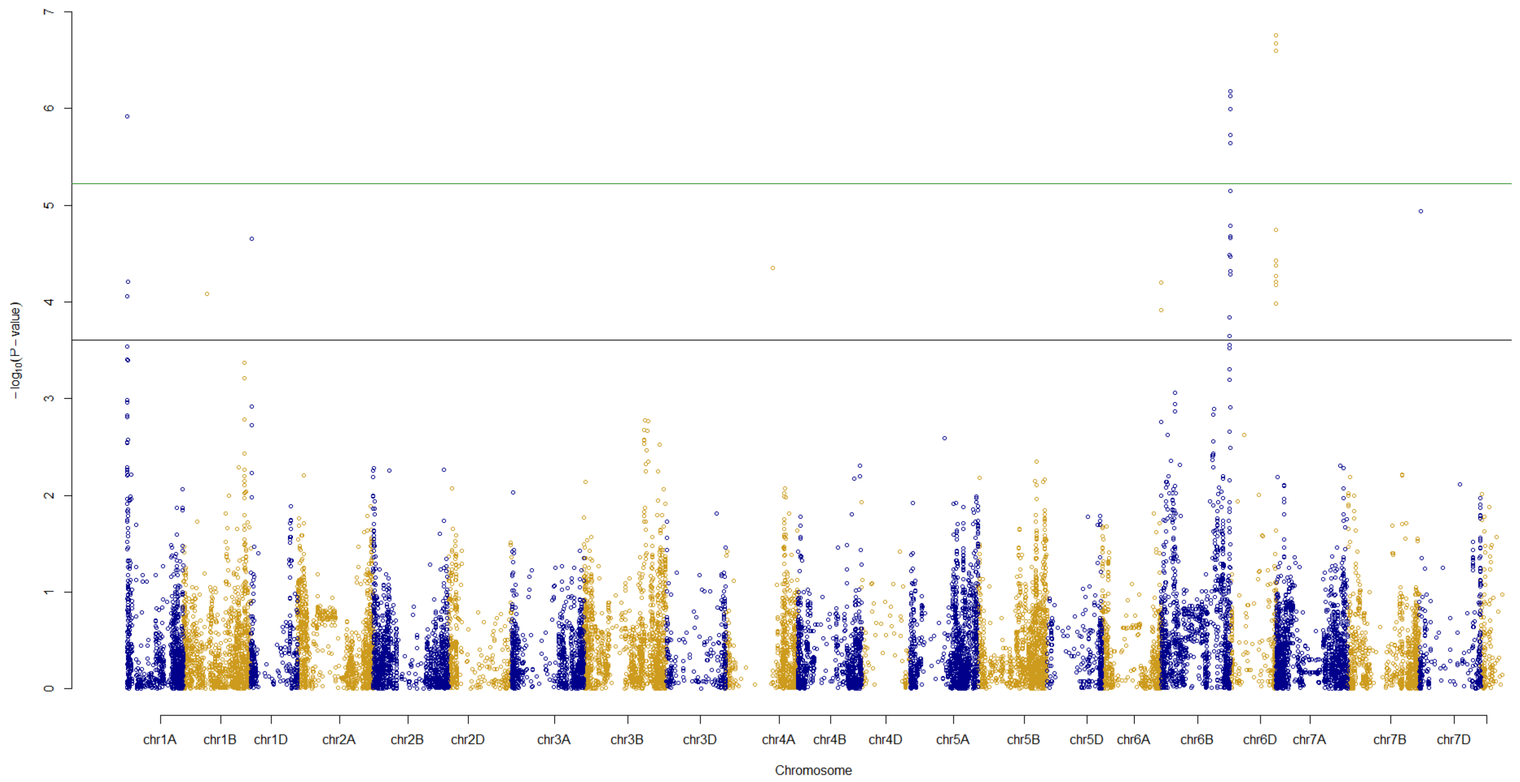


Figure 2: Manhattan plot of GWAS of the BRIWECS panel. The x-axis is the chromosome position and the y-axis is p-value ($-\log_{10}$). The black line is the significance threshold at 5% and the green line is the significance threshold at 1%.

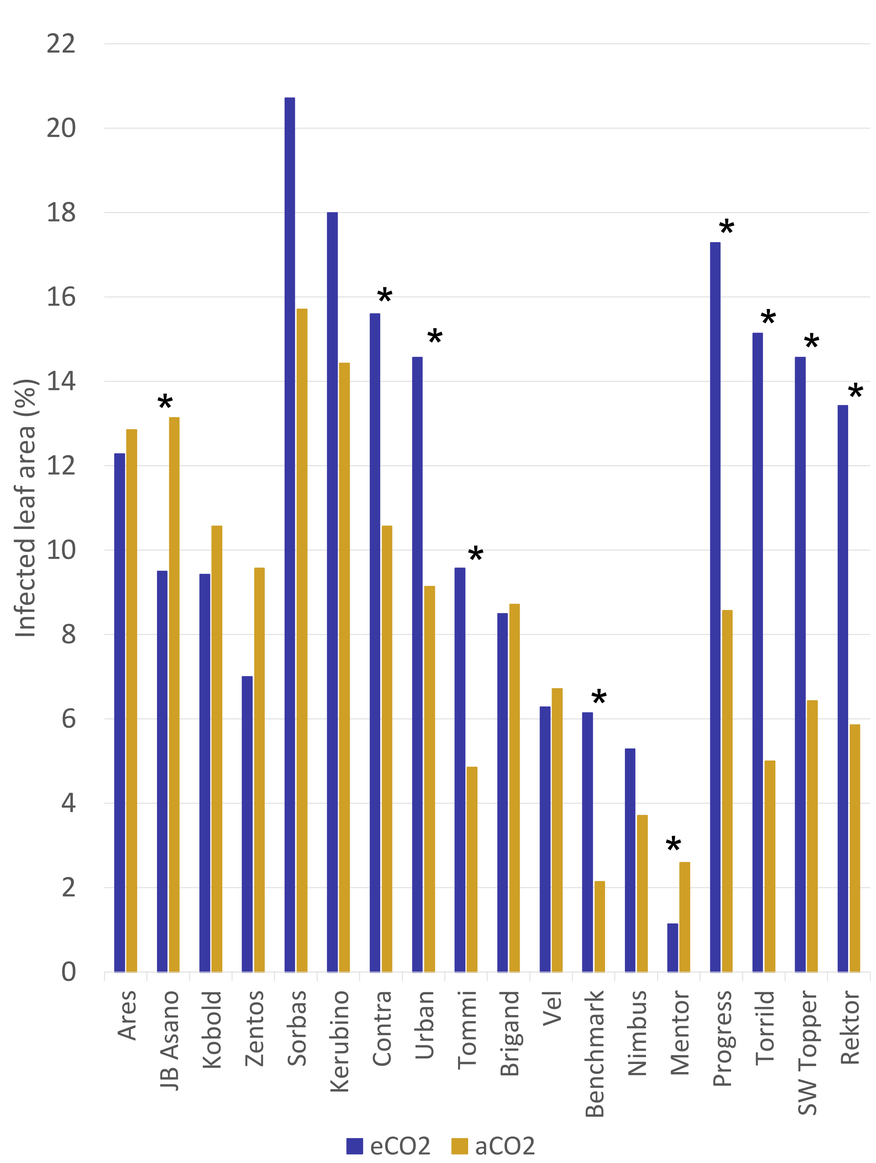


Figure 3: Contrasting varieties for leaf rust infection areas. Significant differences between infected leaf areas according the t-test are indicated in the figure, *p < 0.05.

Summary and Outlook

First results show that elevated CO_2 concentration cause an increased susceptibility to leaf rust on the majority of the investigated varieties. We can confirm the already described breeding progress in resistance breeding against leaf rust, although the breeding progress under elevated CO_2 does not appear to be as pronounced as 410 ppm CO_2. In following experiments the interaction between drought stress and leaf rust susceptibility will be investigated using a contrasting set of varieties. Furthermore two-year field experiments using the FACE (Free Air Carbon Dioxide Enrichment) system are planned to evaluate leaf rust susceptibility under field conditions.

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