



LOCATION OF LOCI FOR RESISTANCE TO *MYCOSPHAERELLA GRAMINICOLA*, PLANT HEIGHT AND HEADING DATE THROUGH GENOME-WIDE ASSOCIATION MAPPING IN WHEAT

Guillermo Gerard^{1,2}, Analía Sanabria^{1,3}, María Rosa Simón¹, Ulrike Lohwasser⁴, Andreas Börner⁴ ¹Faculty of Agriculture and Forestry Sciences, National University of La Plata, 60 and 119. CC 31, 1900 La Plata, Argentina, ²National Agency of Scientific and Technological Promotion (ANPCyT), ³National Council for Scientific and Technological Research (CONICET), ⁴Leibniz-Institut für Pflanzengenetik und Kulturpflanzenforschung (IPK), Corrensstraße 3, 06466 Gatersleben, Germany. ✉ Corresponding author: mrsimon@agro.unlp.edu.ar

Introduction: Septoria leaf blotch, caused by *Mycosphaerella graminicola* (Fuckel) Schrot. (anamorph, *Septoria tritici* Rob. ex Desm) is a major disease of wheat (*Triticum aestivum* L.) worldwide. A great importance fact in the search of resistance to this disease, is its possible association with plant height and heading date. Regarding this, there are phenotypic studies reporting genetic associations between resistance, plant height and heading date (Eyal, 1987), while others argue that this association is rather due to epidemiological or environmental factors (Simón *et al.*, 2004). On the other hand, there are only a few molecular works determining the existence of linkage accurately, most of them developed on biparental populations in which the genetic variability studied is reduced.

Objectives: The aims of this work were to identify (i) marker-trait associations (MTAs) for resistance to *M. graminicola*, plant height and heading date through genome-wide association mapping DArT-based, (ii) the presence / absence of genetic linkage between those traits.

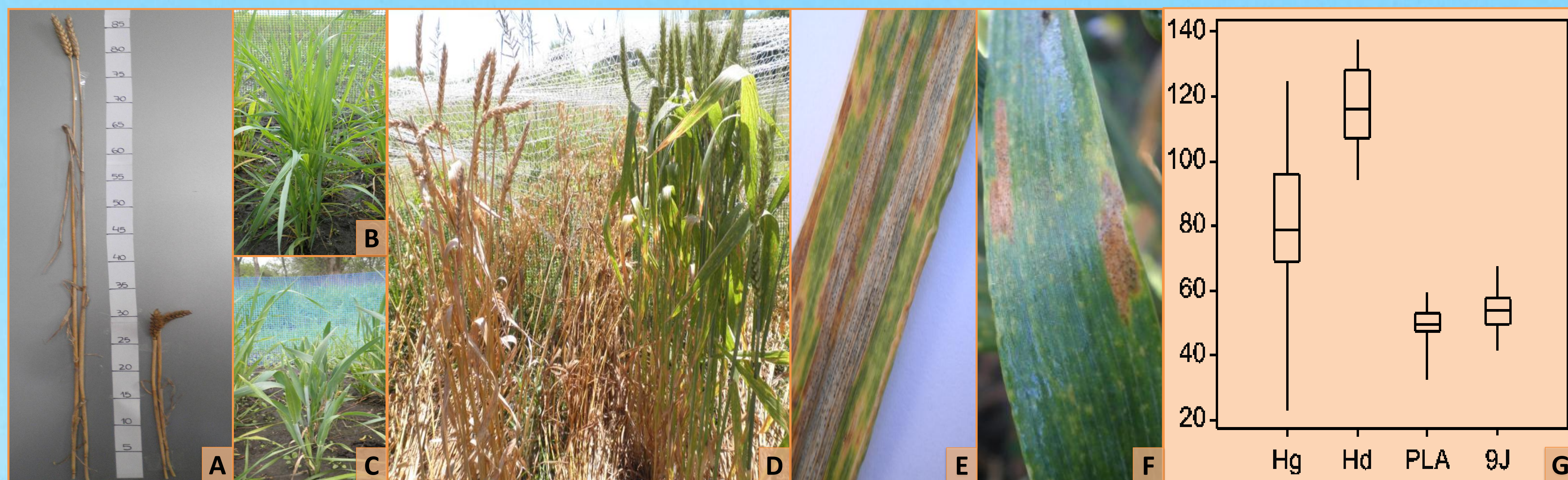


Figure 1: phenotypic variation for adult plant height (A), seedling plant height (B, C), heading date (D), high and low percentage of necrosis (E, F). Boxplot diagram of plant height (Hg), heading date (Hd) and percentage of necrosis for the two isolates: PLA and Nueve de Julio (9J) (G).

Materials and Methods: The test material consisted of two Argentinean spring wheat cultivars susceptible to the disease, used as controls, together with 96 winter wheat accessions originated from 21 countries genotyped with 874 DArT markers. Three field experiments were conducted at the Estación Experimental J. Hirschhorn, Facultad de Ciencias Agrarias y Forestales, Universidad Nacional de La Plata, Argentina, during 2012 and 2013 with a split plot design. The entire collection was inoculated with two isolates from two locations in Argentina (Pla and Nueve de Julio), the conidial suspension was adjusted to 5×10^6 spores ml⁻¹ and sprayed at the 2-leaf stage (GS 12, Zadoks *et al.*, 1974) in both years. For two of the experiments, severity (expressed as necrosis) was scored and for the three experiments, heading date and plant height were evaluated.

Results and conclusions: The percentage of necrosis, plant height and heading date scores indicated a wide phenotypic variation (Fig.1) ranging from 32.4% to 67.6%; 22.97 to 127.7 cm.; and 94 to 138 days respectively. Phenotype-genotype association analysis employing the general linear model (GLM) and mixed linear model (MLM) were performed. Only loci significant with both models were considered associated to the traits. QTLs for *M. graminicola* resistance were detected on chromosome 1AS (two) and 6BL for both experiments with the isolate from Pla. In addition, four significant MTAs on chromosome 1BL (two), 2AS and 2DS for both experiments were effective against the isolate from Nueve de Julio. For heading date, five significant MTAs were detected on chromosomes 1BL, 2BS, 4BL, 5DS and 6AL for the three experiments. For plant height, four significant MTAs were identified on chromosomes 2BS, 3AL, 4AL and 7AL for the three experiments (Fig. 2). Necrosis was negatively associated with both plant height and heading date for both isolates, although for one of the isolates it was only significant for heading date. Only the marker WPT6240 was significantly associated with both heading date and resistance to Nueve de Julio isolate considering the significant MTAs for all experiments.

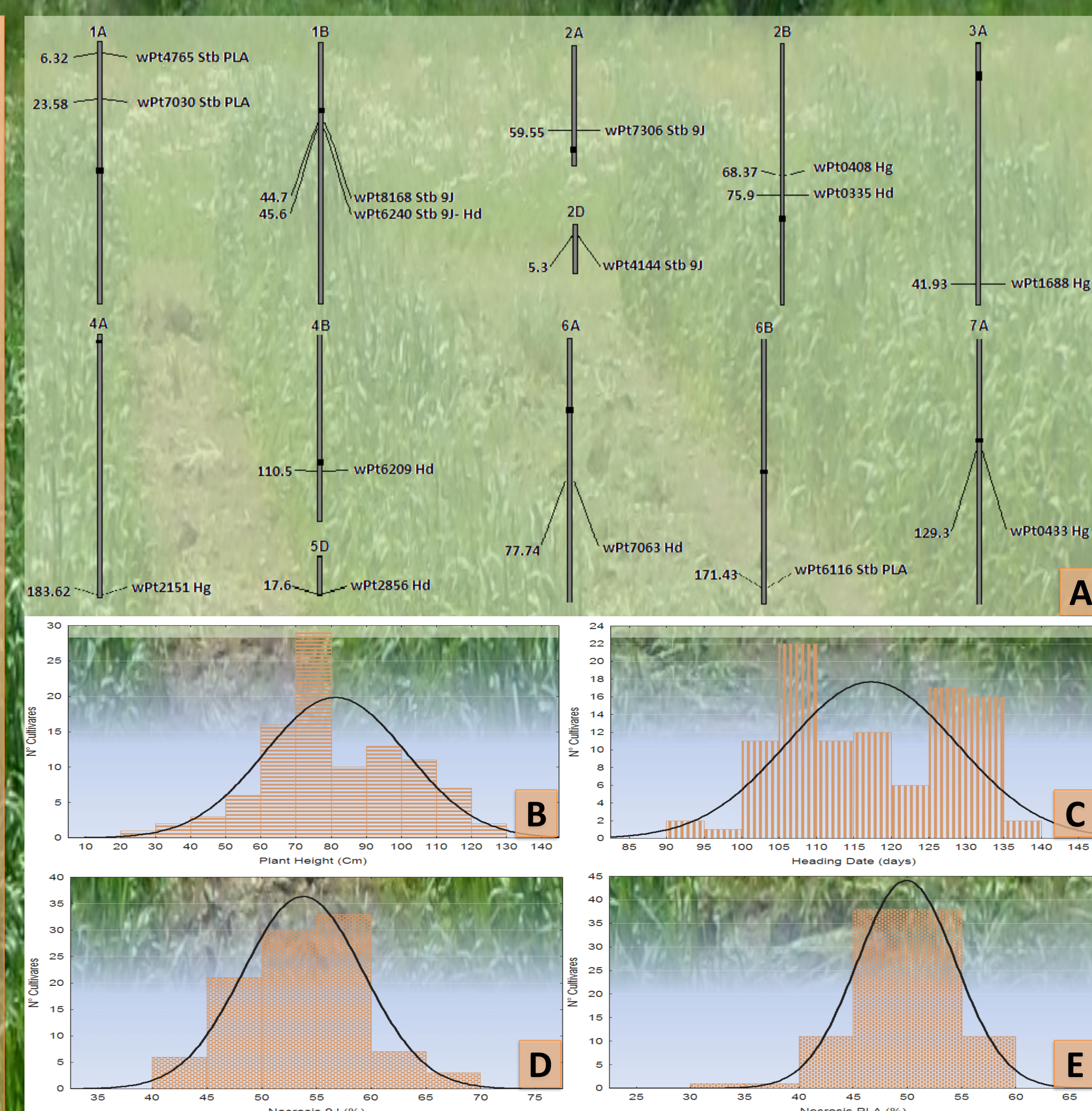


Figure 2: Map for the wheat collection with significant markers for plant height (Hg), heading date (Hd) and percentage of necrosis for the isolates Pla and Nueve de Julio (Stb PLA and 9J) (A). frequency histogram of plant height (B), heading date (C) and percentage of necrosis for the two isolates: PLA (D) and Nueve de Julio (9J) (E).

References:

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Simón MR, Worland AJ, Struik PC, 2004. Influence of plant height and heading date on the expression of the resistance to septoria tritici blotch in near isogenic lines of wheat. Crop Science 44, 2078–85.
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