

Article

Chitosan Hydrochloride Decreases *Fusarium graminearum* Growth and Virulence and Boosts Growth, Development and Systemic Acquired Resistance in Two Durum Wheat Genotypes

Sara Francesconi ^{1,*}, Barbara Steiner ², Hermann Buerstmayr ², Marc Lemmens ², Michael Sulyok ² and Giorgio Mariano Balestra ^{1,*}

¹ Department of Agriculture and Forest Sciences (DAFNE), University of Tuscia, Via San Camillo de Lellis, snc, 01100 Viterbo, Italy

² Department of Agrobiotechnology Tulln (IFA-Tulln), University of Natural Resources and Life Sciences Vienna (BOKU), Konrad Lorenz Straße 20, A-3430 Tulln an der Donau, Austria; barbara.steiner@boku.ac.at (B.S.); hermann.buerstmayr@boku.ac.at (H.B.); marc.lemmens@boku.ac.at (M.L.); Michael.sulyok@boku.ac.at (M.S.)

* Correspondence: francesconi.s@unitus.it (S.F.); balestra@unitus.it (G.M.B.); Tel.: +39-3881839931 (S.F.); +39-0761357474 (G.M.B.)

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Abstract: *Fusarium* head blight (FHB) is a devastating disease for cereals. FHB is managed by fungicides at anthesis, but their efficacy is variable. Conventional fungicides accumulate in the soil and are dangerous for animal and human health. This study assayed the antifungal ability of chitosan hydrochloride against *Fusarium graminearum*. Chitosan reduced *F. graminearum* growth and downregulated the transcript of the major genes involved in the cell growth, respiration, virulence, and trichothecenes biosynthesis. Chitosan promoted the germination rate, the root and coleoptile development, and the nitrogen balance index in two durum wheat genotypes, Marco Aurelio (FHB-susceptible) and DBC480 (FHB-resistant). Chitosan reduced FHB severity when applied on spikes or on the flag leaves. FHB severity in DBC480 was of 6% at 21 dpi after chitosan treatments compared to *F. graminearum* inoculated control (20%). The elicitor-like property of chitosan was confirmed by the up-regulation of *TaPAL*, *TaPR1* and *TaPR2* (around 3-fold). Chitosan decreased the fungal spread and mycotoxins accumulation. This study demonstrated that the non-toxic chitosan is a powerful molecule with the potential to replace the conventional fungicides. The combination of a moderately resistant genotype (DBC480) with a sustainable compound (chitosan) will open new frontiers for the reduction of conventional compounds in agriculture.

Keywords: chitosan; fusarium head blight; durum wheat; plant defense; systemic acquired resistance; fungicides

1. Introduction

Wheat is one of the most cultivated crops worldwide and its annual production is estimated to be more than 700 million tons. Wheat accounts for more than 20% of total human food calories, it is extensively grown on 17% of all crop areas, and it is the staple food for 40% of the world's population, comprising Europe, North America, and the western and northern parts of Asia [1,2]. Modern wheat cultivars refer to two species, the hexaploid bread wheat, *Triticum aestivum* L. and the tetraploid durum-type, *T. turgidum* subsp. *durum* (Desfontaines) Husnache [3,4]. Particularly, durum wheat is the