Pathogenicity patterns of Austrian *Tilletia caries* isolates on winter wheat (*Triticum aestivum*)

University of Natural Resources and Life Sciences, Vienna

Department IFA – Tulln

Elisabeth Ritzer, Magdalena Ehn[1], Michael Oberforster[2], Hermann Buerstmayr[1]

[1] Department of Agrobiotechnology (IFA-Tulln), Institute of Biotechnology in Plant Production, University of Natural Reso2urces and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Str. 20, 3430 Tulln, Austria
[2] AGES (Austrian Agency for Health and Food Safety) , Spargelfeldstraße 191, 1220 Vienna, Austria

INTRODUCTION

Common bunt of wheat, caused by both *Tilletia caries* (D.C.) Tul. (syn. *Tilletia tritici*) and *Tilletia foetida* (Wallr.) Liro (syn. *Tilletia laevis*) is a soil-borne disease with a high potential for reproduction [1,2]. Instead of regular grain filling, bunt balls filled with teliospores are produced, which lead to yield and quality losses [1,2,3]. The teliospores contain trimethylamine which causes an unpleasant fish-like smell [1,2,3]. Especially in organic agriculture, bunt infections may cause severe problems, because chemical seed dressings are not available [1,2,3]. Resistant cultivars are the most efficient way to control the disease. Unfortunately, only few registered cultivars incorporating resistance to common bunt are available [3]. During the last 15 years, an increase of common bunt incidence in Austria has been observed. Additionally, there is evidence that more aggressive races of common bunt can overcome current resistance sources [3].

MATERIALS AND METHODS

In this study eight common bunt isolates collected in various regions of Austria were tested on a set of 40 wheat cultivars. Two isolates were collected in field trials at IFA Tulln, the other six were provided by Michael Oberforster (AGES) and originate from different locations in Austria. The test panel includes the common bunt differential set (carriers of the resistance genes Bt1 to Bt13 and BtP), exotic resistance donors, new breeding lines and some registered cultivars. Each cultivar was artificially inoculated with each isolate. Inoculated seeds were sown in November 2020 with two replications per treatment. From end of May to mid-July 2021 plant traits like ear appearance, flowering time, the presence of awns and plant height were scored. Common Bunt incidence was recorded by assessing 150 spikes per plot as healthy or diseased by cutting them open and checking for the presence of bunt balls. Data analysis included calculation of BLUEs and heritability, ANOVA, testing for significant differences between isolates using Tukeys post-hoc test and calculation of trait correlations.

RESULTS

Statistically significant differences in common bunt incidence were found betweens both genotypes (f(39)=107.72, p < 0.001) and isolates (f(7)=5.72, p<0.001). A Tukey post-hoc test revealed that the isolate originating from Gerhaus resulted in a significantly higher CB incidence on average than Harmannsdorf (+3,33%) and IFA housekeeping (+3.26%). Highest differences in average CB incidence were found between the isolates Loosdorf and Harmannsdorf (+ 4.24%) and Loosdorf- IFA housekeeping Mix (+4,17%) . Different virulence patterns are visualized in a heatmap (Fig. 3).

The differential lines for *Bt1, 5, 6, 11, 12, BtP* as well as 13 other genotypes (mostly belonging to the group *resistance donor*) showed high or complete resistance (less than 5% infected ears) against all eight Austrian isolates. Therefore, future breeding efforts should focus on combining several of these resistance sources. On the other hand, cultivars like Tillstop (31,0%), Tillsano (18,6%), Tilliko (21,6%) and Tillexus (35,8%), which were considered resistant [3], showed moderate susceptibility in the field trial. Therefore, the development of new cultivars resistant to common bunt is of great importance, especially for organic agriculture.

Fig. 1: Infected wheat head: Bunt balls filled with black teliospores are produced instead of regular grain filling. The spores produce an unpleasant fish-like smell.

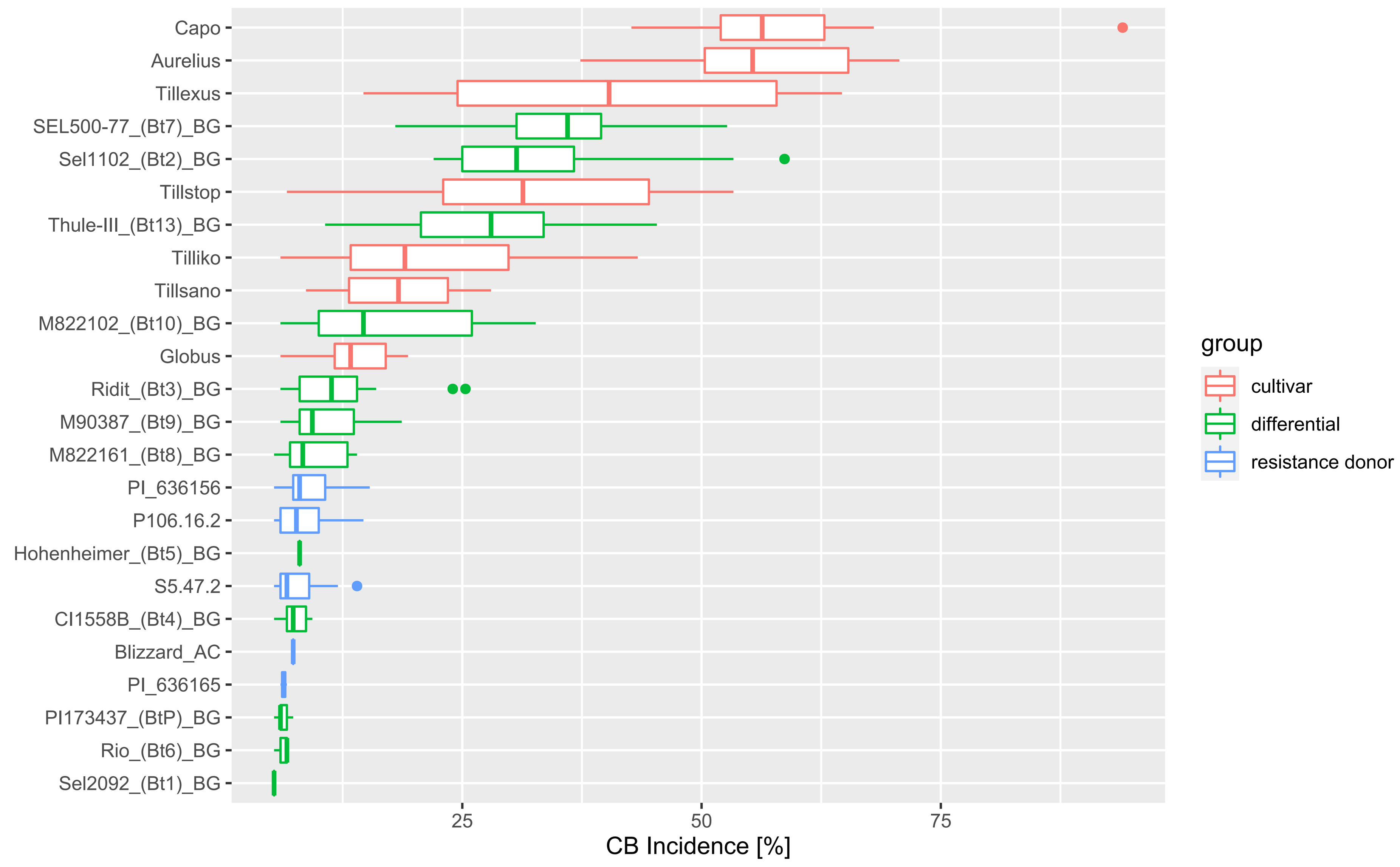

Fig. 2 Boxplot of susceptible cultivars with common bunt incidence [%] on the x-axis and cultivar names on the y-axis sorted by mean infection levels. Cultivars were clustered into genotype groups, which are represented by different colors: red = registered cultivars, green = differential lines, blue = resistance donors. Significant differences were observed between cultivars and groups. Outliers are shown as dots. Resistant cultivars (less than 5% disease severity) were excluded.

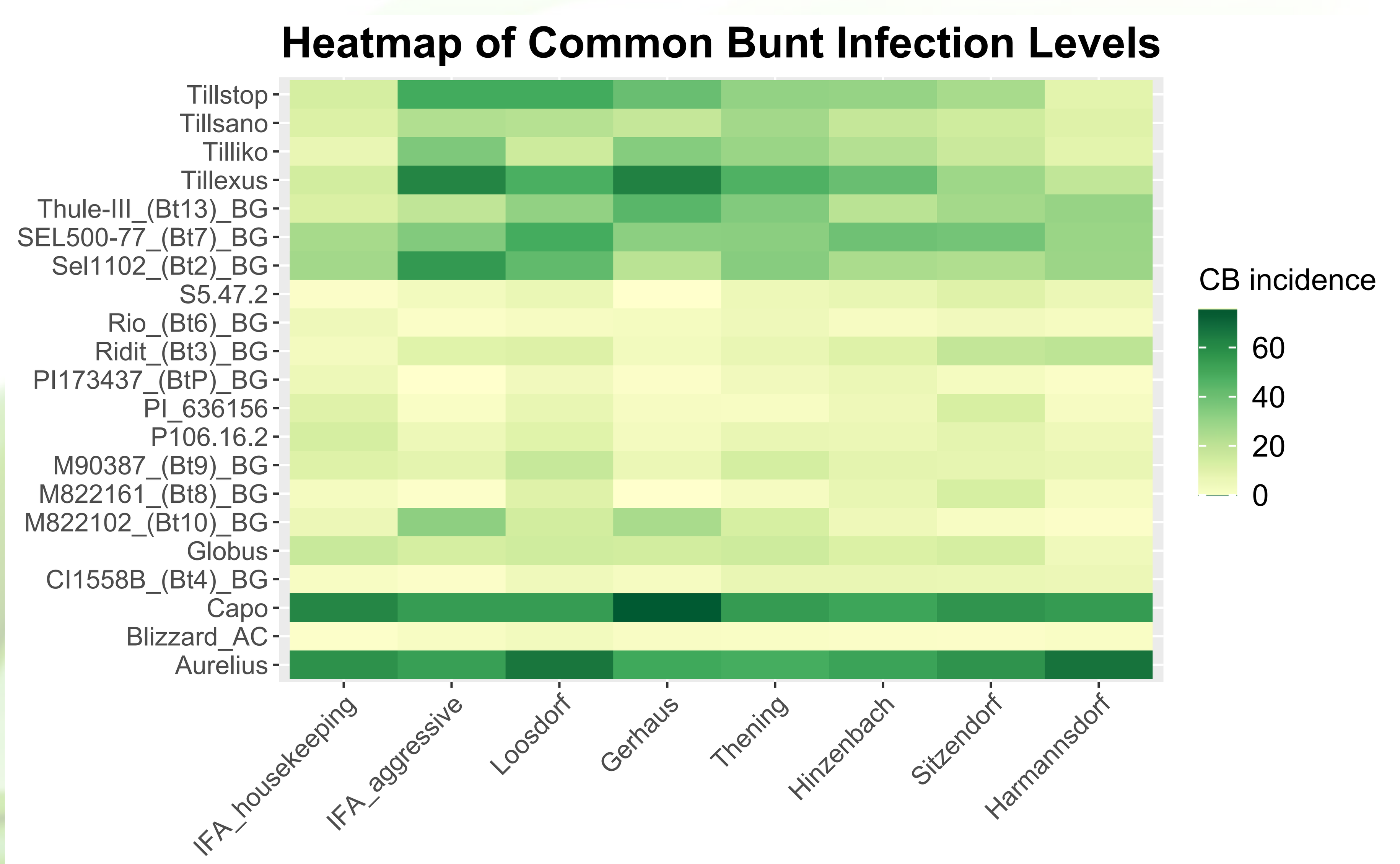

Fig. 3: Heatmap showing common bunt incidence in % for susceptible lines (< 5% CB incidence) tested with eight different isolates. Common bunt incidence (y-axis) per isolate is displayed with different color intensities. Statistically significant differences were found between different locations (f(7)=5.72, p<0.001) and cultivars (f(39)=107.72, p < 0.001) .

REFERENCES:
[1] Goates et al. (2012) *Crop Sci.* 52 (6), S. 2595–2605. DOI: 10.2135/cropsci2012.01.0060.
[2Matanguihan et al. (2011) *Plant disease* 95 (2), S. 92–103. DOI: 10.1094/PDIS-09-10-0620
[3] AGES (2021) https://www.ages.at/themen/landwirtschaft/saat-und-pflanzgut/forschung/gewoehnlicher-steinbrand-und-seine-bedeutung-in-der-bio-landwirtschaft/was-ist-gewoehnlicher-steinbrand/
[4]