Evaluating populations derived from complex crosses involving both bread wheat and durum wheat parentage for partial resistance to crown rot

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A thesis submitted for the degree of

Master of Agricultural Science

at

The University of Adelaide

Faculty of Sciences

School of Agriculture, Food and Wine

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April 2014

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Abstract

Crown rot in durum, caused by *Fusarium pseudograminearum* and *Fusarium culmorum*, can reduce yields up to 90% in seasons characterised by limited spring rainfall. To decrease this potential loss, breeding of partially resistant cultivars could complement agronomic approaches. However, the limited variation in durum has meant that development of partially resistant lines is still a major objective to overcome. The aim of this study was to evaluate, through genotypic and phenotypic-based approaches, durum lines with partial resistance to crown rot. The germplasm under study consisted of 252 durum lines obtained by crossing durum parents with partially resistant bread wheat varieties. Phenotypic assessment of the symptoms, accomplished by visual assessment of the fungal necrosis of the stems, led to the identification of 120 partially resistant lines. Genotypic assessment, performed through a SNP array, identified associations between marker genotype and crown rot severity for the family originating from the parents EGA Bellaroi 38a and Sumai 3. Moreover, the frequency of QTL for crown rot partial resistance already published was investigated in the populations under study through the multiplex ready PCR technique. These findings confirm that bread wheat varieties can be exploited to reduce crown rot severity in durum.

Declaration

The presented thesis does not contain any material already accepted for the award of any other degree or diploma in any University or tertiary institution. To the best of my knowledge and belief, this work does not contain material already published, excepted for everything that is cited.

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Domenico Deserio

December 2013

Acknowledgements

At the end of this challenging journey, I would like to thank my principal supervisor, Dr Jason A. Able, for his precious advice, practical and moral support. Moreover, I wish to acknowledge the meticulous and patient supervision of Professor Diane Mather, who has helped me approaching the genotypic analysis.

I would like to thank also the University of Adelaide, the School of Agriculture, Food and Wine and the Australian Centre for Plant Functional Genomics, especially Professor Peter Langridge for the opportunity to study in Australia. Furthermore, I wish to acknowledge the significant technical support of the Prof. Mather's 'Marker Lab' staff (Elysia Vassos, Rebecca Fox, Genet Mekuria, Greg Lott, Shashi Goonetilleke and Kelvin Khoo). Additionally, I would like to express my gratitude to all the members of the 'Able Lab' and to A/Professor Amanda Able.

The present work has been possible thanks to the help of the seed provider Dr Gururaj Kadkol (New South Wales Department of Primary Industry), the advice of A/Professor Hugh Wallwork and staff (South Australian Research and Development Institute), the suggestions of Professor Eileen Scott and the supply of biological material by Dr Cassandra Malligan (Leslie Research Centre, Toowoomba, Queensland).

As a scholarship recipient, my gratitude goes to all the people and institutions that allowed this experience. Particularly, I thank the Apulia Region for the scholarship 'Ritorno al Futuro – Sud Australia', Dr Nicola Sasanelli for support, help and welcome to Australia. Moreover, I express my gratitude to Dr Angelo Visconti and Dr Antonio Moretti (Institute of Science of Food Production,

CNR, Bari) for the opportunity and scientific support. Finally, a huge and warm thank you to Dr Federico Baruzzi, Dr Leonardo Caputo, Dr Maria Morea and (last but not least!) Dr Laura Quintieri, for their regular support despite the distance during my time in Australia, and since the very beginning of my scientific experience which started 10 years ago.

This achievement would not have been possible to reach without the support that my parents gave me from the other side of the world. I'm also grateful to my brother and his family, my grandmother, my uncles and cousins, and all of my friends back home to whom I have felt close to during these years. Thank you to all my new friends in Australia, all the people that lived with me during this deep experience, sharing the precious value of friendship far away from home.

Above all, this is for you, N.

Glossary of Abbreviations

Abbreviation	Full term
AGRF	Australian Genome Research Facility
ANOVA	Analysis of variance
ASOs	Allele-specific oligonucleotides
AUD	Australian Dollars
cDNA	Complementary deoxyribonucleic acid
CGIAR	Consultative Group for International Agricultural Research
CIMMYT	International Maize and Wheat Improvement Centre
CR	Crown rot
DArT	Diversity arrays technology
DNA	Deoxyribonucleic acid
EDTA	Ethylenediaminetetraacetic acid
EST	Expressed sequence tags
FHB	*Fusarium* Head Blight
GxE	Genotype by environment
I	Inoculated treatment
IARCs	International Agricultural Research Centre
ICARDA	International Centre for Agricultural Research in the Dry Areas
LOD	Logarithm of odds
LSD	Least significant difference
LSO	Locus specific oligonucleotide
MAS	Marker assisted selection
mRNA	messenger ribonucleic acid

Abbreviation	Full term
MRT	Multiplex Ready Technology
NI	Not inoculated treatment
PCNB	Pentachloronitrobenzene
PCR	Polymerase chain reaction
PDA	Potato Dextrose Agar
Ph1	Pairing homoeologous 1
QTL	Quantitative trait loci
R	Correlation coefficient
RCF	Rotation centrifugal force
RFLP	Restriction fragment length polymorphism
S	Susceptible line
SARDI	South Australian Research and Development Institute
SNP	Single nucleotide polymorphism
SSR	Simple sequence repeat