Improving southern anthracnose resistance in red clover

Lea Frey[1], Milena Scandella[2], Franz Schubiger[2], Bruno Studer[1], Roland Kölliker[1]
[1] Molecular Plant Breeding, ETH Zürich, [2] Agroscope Reckenholz

INTRODUCTION

Red clover *(Trifolium pratense* L.*)* is one of the most important forage legumes in temperate climates. It is not only an excellent feed for cattle, but also valued for its ability to fix atmospheric nitrogen, which helps to improve and maintain soil fertility. Southern anthracnose, caused by *Colletotrichum trifolii*, is a devastating disease, leading to severe yield losses.

This study aims to shed light on the genetic control of anthracnose resistance through genome sequencing and genome-wide association studies (GWAS).

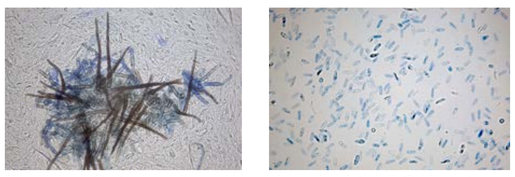

Figure 1: Setae (left) and conidia (right) of *Colletotrichum trifolii*

Figure 2: Disease symptoms one week after spray inoculation

Figure 3: Natural infection with southern anthracnose on susceptible and resistant cultivars

Molecular Plant Breeding

www.mpb.ethz.ch

Institute of Agricultural Sciences,
ETH Zurich, Switzerland

METHODS

- F1 progenies of four reciprocal bi-parental crosses of synthetic breeding material were spray inoculated with a single-spore isolate
- Survivor plants were again spray inoculated with a mixture of seven additional isolates

Figure 4: Spray inoculation with *Colletotrichum trifolii*

Contact Us:

lea.frey@usys.ethz.ch
roland.koelliker@usys.ethz.ch

FIRST RESULTS

- Single isolate inoculation yielded a segregation ratio of 1:1 or 1:0, indicating that one dominant locus is governing resistance
- Subsequent inoculation with the isolate mixture strongly suggested the existence of at least one additional resistance locus
- Genotyping by sequencing of pooled leaf samples revealed potential candidate genes involved in basal defense against fungal pathogens

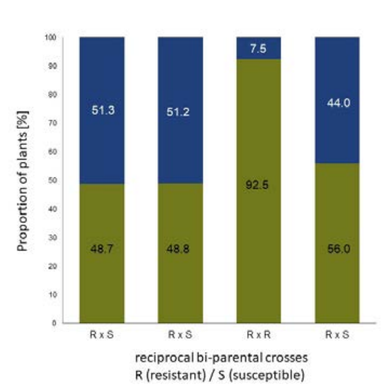

Figure 5: Percentage of plants resistent (green) or susebtible (blue) after inocuating with a single- spore isolate

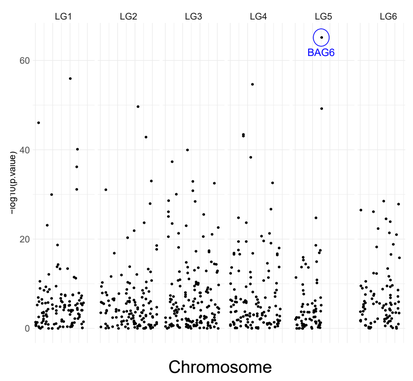

Figure 6: SNPs from GWAS associated with resistance to southern anthracnose

OUTLOOK

- 400 red clover accessions will be spray inoculated in the greenhouse
- All accessions will be screened for anthracnose resistance in the field (five locations)
- Data collected will be used for genome-wide association mapping

Figure 7: Red clover accessions in the greenhouse before spray inoculation with *Colletotrichum trifolii*

Figure 8: Field trial with 400 red clover accessions for resistance phenotyping

References:

- Athow, K. L., & Davis, R. L. (1958). Inheritance of resistance to southern anthracnose in red clover. Phytopathology, 48(8), 437–438
- Jacob I, Hartmann S, Schubiger FX, Struck C (2015) Resistance screening of red clover cultivars to Colletotrichum trifolii and improving the resistance level through recurrent selection. Euphytica 204:303–310. doi: 10.1007/s10681-014-1323-x
- Taylor NL (2008) A century of clover breeding developments in the United States. Crop Sci 48:1–13. doi: 10.2135/cropsci2007.08.0446

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