

## GENETIC MAPPING OF ANTHRACNOSE RESISTANCE IN WHITE LUPIN

Joris A. ALKEMADE<sup>1</sup>, Monika M. MESSMER<sup>1</sup>, Christine ARNCKEN<sup>1</sup>, Agata LESKA<sup>2</sup>, Paolo ANNICCHIARICO<sup>3</sup>, Nelson NAZZICARI<sup>3</sup>, Ralf T. VOEGELE<sup>4</sup>, Maria R. FINCKH<sup>5</sup>, Pierre HOHMANN<sup>1</sup>

<sup>1</sup> Department of Crop Sciences, Research Institute of Organic Agriculture (FiBL), Frick, Switzerland,

<sup>2</sup> Getreidezüchtung Peter Kunz (gzpk), Feldbach, Switzerland,

<sup>3</sup> Council for Agricultural Research and Economics (CREA), Research Centre for Animal Production and Aquaculture, Lodi, Italy,

<sup>4</sup> Institute of Phytomedicine, University of Hohenheim, Stuttgart, Germany,

<sup>5</sup> Department of Ecological Plant Protection, Kassel University, Kassel, Germany

joris.alkemade@fibl.org

**Keywords:** *Lupinus albus*, *Colletotrichum lupini*, breeding, GWAS, phenotyping

White lupin (*Lupinus albus*) is a valuable grain legume with a high protein content and quality, contributing to soil fertility (Monteiro *et al.*, 2014, Lambers *et al.*, 2013). Its high yield potential could make it a sustainable alternative for imported soybean in Europe (Lucas *et al.*, 2015). However, lupin anthracnose, caused by the air- and soil-borne fungus *Colletotrichum lupini* severely limits cultivation as low levels of seed infestation can already cause total yield loss (Talhinhas *et al.*, 2016). Host resistance is crucial for managing anthracnose but a better insight into the genetic basis is required. We developed a high-throughput phenotyping tool that identifies field-relevant anthracnose resistance under controlled conditions. For inoculation, we identified a local, highly virulent *C. lupini* strain. Phylogenetic analyses revealed that the strain belongs to a globally dispersed genetic group corresponding to Dubrulle *et al.*'s (2020) *C. lupini* group II. Using the developed tool we phenotyped a diverse collection of 200 white lupin accessions, revealing a strong segregation between susceptible and resistant plants, potentially holding novel sources of resistance. Genotyping-by-sequencing was performed and the generated single-nucleotide polymorphic markers (SNPs) are currently being used for genetic mapping. Quantitative trait loci (QTLs) for anthracnose resistance will be presented aiding to improve and speed up white lupin breeding programs.

### Acknowledgements

This study is part of the collaborative project LIVESEED: Improving the performance of organic agriculture by boosting organic seed and plant breeding efforts across

Europe, supported by the European Union's HORIZON 2020 research and innovation programme under the Grant Agreement no 727230, and by the Swiss State Secretariat for Education, Research and Innovation (SERI) under contract number 17.00090 and additional support of the Federal Office for Agriculture (FOAG) and Bio Suisse.

## References

- Dubrulle, G., Pensec, F., Picot, A., Rigalma, K., Pawtowski, A., Nicolleau, S., Harzic, N., Nodet, P., Baroncelli, R. & Le Floch, G. 2020. Phylogenetic diversity and effect of temperature on pathogenicity of *Colletotrichum lupini*. *Plant Disease*, 104, 938-950.
- Lambers, H., Clements, J. C. & Nelson, M. N. 2013. How a phosphorus-acquisition strategy based on carboxylate exudation powers the success and agronomic potential of lupines (*Lupinus*, *Fabaceae*). *American Journal of Botany*, 100, 263-288.
- Lucas, M. M., Stoddard, F. L., Annicchiarico, P., Frias, J., Martinez-Villaluenga, C., Sussmann, D., Duranti, M., Seger, A., Zander, P. M. & Pueyo, J. J. 2015. The future of lupin as a protein crop in Europe. *Frontiers in Plant Science*, 6, 705.
- Monteiro, M. R. P., Costa, A. B. P., Campos, S. F., Silva, M. R., da Silva, C. O., Martino, H. S. D. & Silvestre, M. P. C. 2014. Evaluation of the chemical composition, protein quality and digestibility of lupin (*Lupinus albus* and *Lupinus angustifolius*). *O Mundo da Saúde, São Paulo*, 38, 251-259.
- Talhinhas, P., Baroncelli, R. & Le Floch, G. 2016. Anthracnose of lupins caused by *Colletotrichum lupini*: a recent disease and a successful worldwide pathogen. *Journal of Plant Pathology*, 98, 5-14.