Sclerotinia stem rot discovery to improve resistance in canola

AUSTRALIAN researchers have discovered three genes associated with resistance to sclerotinia stem rot, marking a major step towards developing improved disease-resistant canola varieties for growers.

The genes have links to sclerotinia stem rot susceptibility and resistance. Sclerotinia stem rot is a fungal disease which can significantly reduce the productivity of a grower's canola crop.

The discovery could arm breeders with information on how to develop canola varieties with improved resistance against the disease.

Researchers from the Centre for Crop and Disease Management (CCDM), in collaboration with the New South Wales Department of Primary Industries (NSW DPI) and Agriculture and Agrifood Canada (AAFC) identified the genes.

CCDM researcher and lead author Dr Toby Newman said the finding represents a major step in the development of tools that canola breeders can use to produce varieties with much improved resistance to sclerotinia stem rot.

"It's tricky to breed resistance to sclerotinia stem rot in canola because a broad range of genes contribute to susceptibility and resistance," Toby said. "As far as we know, no single gene will provide a good level of resistance against sclerotinia stem rot, and unfortunately, we are unlikely to achieve complete resistance to this disease, but we can put together smaller puzzle pieces to create a strong partial resistance.

"We must develop varieties with numerous genes, each with small effects that together create crops strong enough to reduce the severity of sclerotinia stem rot for the industry, and this is exactly what we are on the path to achieving with this discovery."

Toby said their research used the model species *Arabidopsis thaliana*, which is in the same family of plants (Brassicaceae) as canola *(Brassica napus)*.

"We found two genes that make Arabidopsis more susceptible to the disease and one gene which increases resistance to it," he said. "Identifying these genes means we can infer that the corresponding genes in canola, are likely to react similarly, working to make the plant more susceptible or resistant, but this resistance is yet to be proven in this crop.

"Breeders can soon use this information to improve genomic selection accuracy to select for more resistant lines in their breeding program."

Co-author and CCDM researcher Dr Mark Derbyshire said although more work needs to be done to validate the roles of these genes in canola, as part of the study, the team also rescreened some canola lines in a controlled environment growth room at CCDM.

"From this we were able to validate two varieties to show strong partial resistance to sclerotinia stem rot pathogens," said Mark.

Great potential

"We are unsure if these lines contain the newly discovered genes, but we do know that these lines are ready to be utilised.

"We highly recommend that breeders start incorporating these lines into their breeding programs as they have great potential to enhance sclerotinia stem rot resistance in commercial canola varieties."

CCDM Director Professor Mark Gibberd said this discovery is a significant step forward in sclerotinia stem rot research enabled by CCDM's co-investment by Curtin University and the Grains Research and Development Corporation (GRDC).

"Since 2019, our canola and pulse researchers have been continuing to build on their initial discovery of partial resistance to sclerotinia stem rot," said Mark.

"We hope the latest identification of genes contributing to resistance and susceptibility will eventually allow growers to access canola lines from breeders that are far more capable of coping with this threatening disease.

"Our researchers will continue their work developing tools and techniques required to incorporate higher levels of resistance into commercial canola varieties to limit yield loss for growers battling this disease in their paddocks."

CCDM is a national centre co-supported by GRDC and Curtin University.

The discovery of the three genes has been published in the scientific journal Phytopathology. For more, watch the video on CCDM's YouTube channel.

Read the paper entitled "Association Mapping Combined with Whole Genome Sequencing Data Reveals Candidate Causal Variants for Sclerotinia Stem Rot Resistance in Brassica napus". ■

Dr Toby Newman working with the model plant species *Arabidopsis thaliana*. (PHOTO: CCDM)