Aspects of epidemiology of *Phoma koolunga* (ascochyta blight of field pea)

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Abstract

Ascochyta blight (blackspot) is a significant disease of field pea (*Pisum sativum*) with worldwide distribution, causing grain production losses of 15 % per annum in Australia. *Phoma koolunga* is a relatively new pathogen of this complex disease in Australian field pea crops. This thesis reports information about aspects of the epidemiology of this fungus in Australian conditions.

The survival of *P. koolunga* on field pea stubble and as pseudosclerotia buried in field soil was examined. The frequency of recovery of this fungus declined over time and it was not recovered from stubble buried in soil or placed on the soil surface in pots outdoors at months 11 and 15, respectively, and later. Pseudosclerotia were produced in Petri dishes containing potato dextrose agar (PDA) amended with fluorocytocin or with sand. The maximum longevity of pseudosclerotia buried in soil in pots outdoors was less than 18 months. Infectivity of inoculum of the fungus decreased over time, as the mean number of lesions on plants inoculated with stubble buried or left on the soil surface for up to 6 and 5 months, respectively, and pseudosclerotia retrieved at 14 months and later from field soil did not differ from the water control in a pot bioassay.

P. koolunga was isolated from field pea seed samples harvested from South Australia and Victoria. Disease was transmitted to 98 % of seedlings that emerged from artificially inoculated seeds (AIS) in growth room conditions. Seedling emergence rate from AIS at 8° C soil temperature was lower than at 12, 16 and 20° C and also disease severity on seedlings was greater at the lower temperature. Efficacy of fungicides as seed dressings was examined on AIS. P-Pickel T® and Jockey Stayer® were the most effective fungicides among six tested for reducing

disease incidence and severity due to *P. koolunga* on seedlings that emerged from AIS sown in soil and on germination paper, respectively.

The reaction of 12 field pea genotypes to one moderately virulent isolate of *P. koolunga* was evaluated by spraying a pycnidiospore suspension on plants in controlled conditions and assessing disease severity at 2-5 day intervals for 21 days. Sturt, Morgan and Parafield showed more severe disease on leaves than the other genotypes at 21 days post-inoculation (dpi), and Kaspa, PBA Twilight, PBA Oura, PBA Wharton and WAPEA2211 were less susceptible. When three isolates of *P. koolunga* which varied in virulence were sprayed on four genotypes of short, semi-leafless type peas, Morgan and WAPEA2211 showed more disease than Kaspa at 21 dpi. Aggressiveness of isolates of *P. koolunga* on these four genotypes differed based on % leaf area diseased up to 14 dpi, but this difference had disappeared by 21 dpi.

Some isolates of *P. koolunga* from seeds showed atypical morphology and reproductive behaviour. These cultures had rhizoid form mycelia on growth media such as PDA. Also, some atypical cultures of *P. koolunga* sectored from typical colonies on PDA. These sectors and cultures were confirmed as *P. koolunga* by DNA test using *P. koolunga*-specific primers. Mycelium from these sectors produced small lesions on leaves and stems of field pea seedling resembling ascochyta blight symptoms in controlled conditions. Pycnidium-like structures of these atypical cultures did not contain pycnidiospores, but had many round and hyaline fatty guttulae of different sizes, usually smaller than normal spores of *P. koolunga* which never germinated.

Crossing 19 isolates of *P. koolunga* in vitro failed to initiate formation of pseudothecia of *P. koolunga* on pea stem pieces or on several growth media. This

fungus might need specific environmental conditions for production of pseudothecia which still are unknown.

The results of this study provide information about survival of *P. koolunga*, transmission to seedlings via infected seed, control of the fungus in seed and also reaction of field pea genotypes to this pathogen in South Australian conditions. These findings improve the understanding of epidemiology of this disease and consequently can help to improve management of this pathogen in the field.

Declaration

I, Mohsen Khani, certify that this work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Author Contributions

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