Epidemiology of ascochyta blight of chickpea in Australia

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Summary

In Australia, chickpea is a relatively new, but rapidly expanding, grain legume crop that has received considerable attention in the cereal belt of southern Australia. The present study was conducted to determine the etiology of a blight disease of chickpea in southeastern Australia and the factors affecting disease development. The disease had previously been identified as phoma blight.

A range of Phoma-like isolates from chickpea in South Australia were tested for pathogenicity to roots and foliage in a series of preliminary experiments. Inoculation techniques were standardised and conidial suspension was found to be the most appropriate inoculum. Conidial suspensions were used in the subsequent experiments. Pathogenicity testing of nine Phoma-like isolates revealed two isolates that were highly pathogenic. They were subsequently identified as Ascochyta rabiei based on morphological characters, and by collaborators using RAPD-PCR in France and mating type studies in Italy. These isolates were accessioned in the Agricultural Scientific Collections Unit, NSW Agriculture as DAR 71767 and DAR 71768. This is the first time that A. rabiei has been conclusively identified in commercial crops in the southern hemisphere. Additional isolates of A. rabiei were obtained from commercial crops in South Australia during 1996 and 1997 and South Australia, Victoria, New South Wales and Queensland during the 1998 growing season.

Screening of chickpea varieties in the greenhouse revealed that, of the desi types, Dooen was the most resistant to ascochyta blight, followed by Tyson, Norwin and Heera, whereas Desavic was highly susceptible, and of the kabuli types, Kaniva, Garnet and Bumper ranged from moderately susceptible to susceptible. Lines ICC 1151x ILC3279, ICC 1151xIL C482, NIFA-88 and CM-72 imported from Pakistan, were also found to be resistant to DAR 71767 while Noor-91 and Paidar-91 were susceptible.

The effects of plant age and environmental conditions on disease development were investigated in a series of experiments conducted under controlled conditions in growth rooms. Seedlings of cv. Desavic were more susceptible than older plants. The optimum conditions for ascochyta blight were 20°C and a 48-96 h period of leaf wetness. The disease development was negatively influenced by interrupting the wetness period with more than 6h dryness, but less than 6h dryness lead to increased disease.

The response of five chickpea cultivars to inoculation with A. rabiei in the field was evaluated over three consecutive years. It was observed that the disease intensity
increased over time, especially in cv. Desavic, which was killed 7 weeks after inoculation in 1997. Disease in 1998 was not as severe as in commercial crops, probably due to unusually dry weather and weed infestation of the field trial. Disease severity in resistant and susceptible cultivars was consistent both in greenhouse and field conditions.

The host range of *A. rabiei* was tested by inoculating 29 plant species with DAR 71767 and maintaining them in the greenhouse in humid conditions for 72 h at 20 ± 5°C. The isolate was pathogenic to chickpea and four common bean varieties (*Phaseolus vulgaris* L.), Brown-boy, CH-190-7D, Cran-34 and Rain-bird, only.

The means of penetration of the chickpea host was established in histological studies using conventional light microscopy and confocal microscopy. *A. rabiei* was found to penetrate leaf tissues through guard cells, stomata, directly through cell walls and between epidermal cells. This is the first report of penetration by the pathogen through stomata.

The phytotoxins, solanapyrones A and C, were identified in culture filtrates of Australian isolates, DAR 71767, DAR 71768 and 215/91, by comparison with standard reference toxins. The level of solanopyrone C increased gradually with age of the culture. The presence and concentration of the toxins were consistent as determined by thin layer chromatography, high performance liquid chromatography and mass spectrometry. In a preliminary bioassay, leaves of cultivars Dooen and Desavic, treated with purified culture filtrate, became necrotic.

All cultures of *A. rabiei* isolated, to date, in Australia have been shown to be mating type MATI-1, by pairing with reference mating types in Italy and the USA. The teleomorph has not been observed in field material nor was it induced in infected chickpea debris nor inoculated chickpea straw incubated in conducive conditions in South Australia.

The study, therefore, clarified the confusion between phoma and ascochyta blight in Australia, and provided advance warning of this disease for the expanding Australian chickpea industry. Confirmation of ascochyta blight has allowed the implementation of appropriate disease management strategies. Resistance identified in breeding lines will be helpful to the National Chickpea Breeding Program. Other important outcomes include the recommendations that (i) cv. Desavic, currently widely grown, should not be grown where ascochyta blight is likely to be a problem as it is highly susceptible; (ii) quarantine restrictions on the import of chickpea seeds be maintained to prevent the introduction of MATI-2.