THE BIOHERBICIDAL POTENTIAL OF THE SEED-BORNE PATHOGEN *PYRENOPHORA SEMENIPERDA* FOR CONTROL OF ANNUAL GRASS WEEDS IN CEREAL CROPS

BY

Mathew Alexander Campbell
B.Sc. (Hons) New England

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Department of Botany
University of New England
Armidale NSW 2351
Australia

DECLARATION OF ORIGINALITY

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree.

I certify that to the best of my knowledge, any help in preparing this thesis and all sources used have been acknowledged in this thesis.

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ABSTRACT

Annual grass weeds are a major limitation to cereal production throughout the world and reproduce and spread only by the production of seed. One strategy for the control of annual grass weeds may be the inundative application of indigenous seed-borne pathogens as mycoherbicides to curb seed production and therefore re-infestation. A feasibility study was undertaken to investigate the potential of the seed-borne pathogen *Pyrenophora semeniperda* for bioherbicidal control of the grass weed *Bromus diandrus*.

The requirements for optimal growth and sporulation were defined. Growth and sporulation were optimal at 23.2 °C and 19.2 °C respectively when grown on modified alphacel medium with a pH of between 4.7 and 5.7. *P. semeniperda* required mycelial wounding and an alternating light/dark sequence for best sporulation with light wavelengths shorter than 500 nm.

The variation in growth and sporulation of isolates of *P. semeniperda* was investigated after using single-spore and mass transfer isolation techniques and storage. Some variation occurred but was attributed to chance and not genetic make-up. Conidia stored in aqueous suspension retained viability and pathogenicity for three months.

P. semeniperda was shown to produce toxic metabolites under *in vitro* conditions. Using a bioassay which used coleoptile and radicle length as an assay of toxicity, it was shown that filtrates of *P. semeniperda* cultures had a severe impact on seedling growth of both wheat and *B. diandrus*. Infiltration of leaves with culture filtrates resulted in symptoms similar to those produced by conidial inoculation.

The infection process of *P. semeniperda* on seedling and adult leaves of wheat and *B. diandrus* and floral tissue of wheat was investigated. Appressoria were formed as an essential component of the infection process on leaf material but not on floral tissue. Resistance to infection was associated with the formation of papillae. Infection hyphae ramified intercellularly in spaces of the mesophyll in leaf material and within the confines of the epidermis and integuments of developing caryopses.

The environmental and physical factors influencing infection of wheat leaves and florets and *B. diandrus* leaves tested were dew period temperature, dew period duration, light requirements during the dew period and physiological age of host. The optimum temperature

for lesion development on wheat leaves was 20.6 ±0.3°C, whilst the optimum for infection of developing wheat caryopses was 23.0 ±0.6°C. A dew period of 21 h and 48 h duration was required for maximal infection of wheat leaves and seeds respectively. An initial dark phase during the dew period was a requirement for infection of wheat and *B. diandrus* leaves. Infection of wheat seeds occurred at all stages of inflorescence development tested with a maximal proportion when inflorescences were inoculated at the end of anthesis (GS 70).

The infection of field grown and inoculated grass species was investigated in three trials in Armidale, NSW and one in Orange, NSW. In one trial 73 % of *B. diandrus* seeds were infected by the fungus. Several different inoculum types were trialed. Application of conidia resulted in the greatest level of infection and application of mycelium resulted in moderate levels of infection. *P. seneniperda* was able to infect a variety of annual grass species under field conditions.

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