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Electrochemical Biosensor for the Detection of Botrytis spp. in Temperate Legume Crops

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Abstract : A greater achievement in the Integrated Disease Management (IDM) to prevent the loss would result from early diagnosis and quantitation of the causal pathogen species for accurate and timely disease control. This could significantly reduce costs to the growers and reduce any flow on impacts to the environment from excessive chemical spraying. Necrotrophic fungal disease botrytis grey mould, caused by Botrytis cinerea and Botrytis fabae, significantly reduce temperate legume yield and grain quality during favourable environmental condition in Australia and worldwide. Several immunogenic and molecular probe-type protocols have been developed for their diagnosis, but these have varying levels of species-specificity, sensitivity, and consequent usefulness within the paddock. To substantially improve speed, accuracy, and sensitivity, advanced nanoparticle-based biosensor approaches have been developed. For this, two sets of primers were designed for both Botrytis cinerea and Botrytis fabae which have shown the species specificity with initial sensitivity of two genomic copies/µl in pure fungal backgrounds using multiplexed quantitative PCR. During further validation, quantitative PCR detected 100 spores on artificially infected legume leaves. Simultaneously an electro-catalytic assay was developed for both target fungal DNA using functionalised magnetic nanoparticles. This was extremely sensitive, able to detect a single spore within a raw total plant nucleic acid extract background. We believe that the translation of this technology to the field will enable quantitative assessment of pathogen load for future accurate decision support of informed botrytis grey mould management.

Keywords : biosensor, botrytis grey mould, sensitive, species specific
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