

STUDY OF *PYTHIUM* ROOT DISEASE OF HYDROPONICALLY GROWN CROPS, WITH EMPHASIS ON LETTUCE

by

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RESUMÉ

Eight species of *Pythium*, *P. acanthicum*, *P. aphanidermatum*, *P. coloratum*, *P. diclinum*, *P. irregulare*, *P. myriotylum*, *P. perplexum*, *P. spinosum*, and representatives of five heterothallic groups, F, G, HS, P and T, were isolated from roots and crowns of crops and from nutrient solutions, substrates, water sources and run-off water in 11 commercial hydroponic systems in South Africa. *P.* group F was isolated most frequently and from the greatest variety of crops, followed by *P. irregulare*, *P. spinosum*, *P. aphanidermatum* and *P.* group HS. *P. acanthicum* was recorded for the first time on strawberry in South Africa, *P. aphanidermatum* on parsley, *P. coloratum* on lettuce, *P. irregulare* on Chinese cabbage and lettuce, *P. perplexum* on tomato, *P.* group G on lettuce, and *P.* group HS on cucumber and lettuce.

The pathogenicity of five of the above *Pythium* species and three heterothallic groups to butter head lettuce was determined at 21 °C and 28 °C in three hydroponic systems, viz. static nutrient solution, hydroculture and a recirculating gravel system. Overall, *P. spinosum* was the most aggressive species at 21 °C, followed by *P. irregulare* and *P.* group HS. *P. myriotylum* was the only species which consistently showed greater virulence at 28 °C than at 21 °C. No significant differences in virulence at the two temperatures were evident with *P. coloratum*, *P. diclinum* and *P.* groups F and T.

Various chemical disinfectants were evaluated for the suppression of *Pythium* and *Fusarium* populations in naturally-infested gravel utilised as substrate in recirculating gravel systems. Overall, the *Fusarium* population was more resistant to chemical treatment than the *Pythium* population. Total control of both *Pythium* and *Fusarium* was obtained with dazomet at 20 and 30 g m⁻² and formaldehyde at 10 ml l⁻¹. Metham-sodium at concentrations as low as 5 ml l⁻¹ reduced the *Pythium* population to zero and was also highly effective against *Fusarium*. Significant, albeit not total, control of *Pythium* was achieved with formaldehyde at 5 ml l⁻¹, hydrogen peroxide + formic acid at 25 ml l⁻¹, methyl bromide + chloropicrin at 100 g m⁻², polydimethyl ammonium chloride at 10 ml l⁻¹ and sodium hypochlorite at 50 ml l⁻¹. Formic acid + hydrogen peroxide and polydimethyl ammonium chloride were also highly effective against *Fusarium*.

STUDIE VAN *PYTHIUM* WORTELSIEKTE BY HIDROPONIESE GEWASSE, MET DIE KLEM OP BLAARSLAAI

deur

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SAMEVATTING

Agt spesies van *Pythium*, *P. acanthicum*, *P. aphanidermatum*, *P. coloratum*, *P. diclinum*, *P. irregulare*, *P. myriotylum*, *P. perplexum*, *P. spinosum*, en verteenwoordigers van vyf heterotalliese groepe, F, G, HS, P en T, is geïsoleer vanaf wortels en krone van gewasse in 11 kommersiële hidroponiese sisteme in Suid-Afrika, asook vanuit voedingsoplossings, substrate, waterbronne en afloopwater in die hidroponikums. *P.* groep F is mees dikwels geïsoleer en vanaf die grootste verskeidenheid van gewasse, gevolg deur *P. irregulare*, *P. spinosum*, *P. aphanidermatum* en *P.* groep HS. *P. acanthicum* is vir die eerste keer in Suid-Afrika geïsoleer vanaf aarbei, *P. aphanidermatum* vanaf pietersielie, *P. coloratum* vanaf blaarslaai, *P. irregulare* vanaf Chinese kool en blaarslaai, *P. perplexum* vanaf tamatie, *P.* groep G vanaf blaarslaai en *P.* groep HS vanaf komkommer en blaarslaai.

Die patogenisiteit van vyf van die bogenoemde *Pythium* spesies en drie heterotalliese groepe teenoor botterslaai is by 21 °C en 28 °C bepaal in drie hidroponiese sisteme, nl. statiese voedingsoplossing, hidrokultuur en 'n hersirkulerende gruisstelsel. *P. spinosum* was die aggressiefste spesie by 21 °C, gevolg deur *P. irregulare* en *P.* groep HS. *P. myriotylum* was die enigste spesie wat konsekwent meer aggressief was by 28 °C as by 21 °C. Die aggressiwiteit van *P. coloratum*, *P. diclinum* en *P.* groepe F en T by die twee temperature het nie betekenisvol

verskil nie.

Verskeie chemiese ontsmettingsmiddels is geëvalueer vir die onderdrukking van *Pythium* en *Fusarium* populasies in natuurlik-besmette substraatgruis afkomstig van 'n hersirkulerende gruisstelsel. Die *Fusarium* populasie was oor die algemeen meer bestand teen chemiese behandeling as die *Pythium* populasie. Volkome beheer van *Pythium* sowel as *Fusarium* is verkry met dasomet teen 20 en 30 g m⁻² en formaldehid teen 10 ml l⁻¹. Metam-natrium teen 'n konsentrasie so laag as 5 ml l⁻¹ het die *Pythium* populasie uitgewis en was ook baie doeltreffend teen *Fusarium*. Betekenisvolle, alhoewel nie totale, beheer van *Pythium* is behaal met formaldehid teen 5 ml l⁻¹, miersuur + waterstofperoksied teen 25 ml l⁻¹, metielbromied + chloropikrien teen 100 g m⁻², polidimetiel-ammoniumchloried teen 10 ml l⁻¹ en natriumhipochloriet teen 50 ml l⁻¹. Miersuur + waterstofperoksied en polidimetiel-ammoniumchloried was ook besonder doeltreffend teen *Fusarium*.