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Epidemiology of citrus black spot disease in South Africa and its impact on phytosanitary trade restrictions

by

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This thesis is dedicated to Drikus Truter

Epidemiology of citrus black spot disease in South Africa and its impact on phytosanitary trade restrictions

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Abstract

Citrus black spot (CBS), caused by *Guignardia citricarpa* Kiely, occurs in various citrus producing regions of the world. Due to the potential phytosanitary risk associated with the export of fruit from CBS positive production areas to CBS-free countries, restrictive trade barriers have been introduced. This study aimed to further elucidate some epidemiological aspects of CBS that can be used to address critical questions identified in the pest risk assessment submitted by South Africa to the World Trade Organisation to address phytosanitary trade restrictions.

Results indicated that Eureka lemon leaf litter exposed to viable pycnidiospores under controlled conditions or in the field in different production regions of South Africa, were not infected and colonised by *G. citricarpa*. Symptomatic CBS fruit or peel lying on the ground underneath citrus trees therefore can not lead to infection and colonisation of freshly detached leaves or leaf litter, or represent a source of inoculum in citrus orchards. Symptomatic fruit therefore pose no danger for the establishment of the pathogen in CBS-free orchards and are not considered to be a pathway for the pathogen.

The period of leaf susceptibility to *G. citricarpa* was indicated to be maximum eight and ten months from development, for Valencia orange and Eureka lemon, respectively, in a greenhouse study. The susceptibility period of citrus leaves to infection by the black spot pathogen could be longer than previously perceived.

Ascospores were captured, using the newly developed Kotzé Inoculum Monitor (KIM), from natural Valencia orange and Eureka lemon leaf litter during October to March with peak ascospore availability between December to February. The KIM is the first sampler designed to capture fungal spores directly from plant material in the laboratory without environmental influences and was effectively used to confirm that ascospores production

is seasonal. The KIM in combination with environmental data can be used to improve control through more targeted fungicide applications.

Techniques such as isolations and DNA amplification with species-specific primers to detect the pathogen directly from symptomless green leaves have a low success rate due to the restricted growth of the pathogen in latently infected tissue. Artificial leaf wilting enhanced the detection of *G. citricarpa* from symptomless leaves. Leaf wilting is a reliable, fast and effective method to detect the CBS pathogen and can be applied to monitor citrus nurseries and orchards throughout the year. It can also be applied to monitor pest-free orchards to maintain its CBS pest-free status.

This study confirmed that sanitation practices, such as leaf litter removal and mulching of leaf litter with wheat straw can decrease the primary inoculum, ascospores, of CBS and contribute to better management of the disease in a commercial orchard. Regardless of the prevailing climatic conditions each year, control achieved through leaf litter management resulted in >95% clean fruit and are equal to the control achieved with industry standard fungicides. This approach provided improved integrated disease control and an alternative to chemical control.

DECLARATION

I, the undersigned, hereby declare that this thesis, submitted for the degree of Doctor of Philosophy, Plant Pathology, is my own and original work except where acknowledged. This work has not been submitted for a degree at any other tertiary institution.

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Mariette Truter

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TABLE OF CONTENTS

Abstract i

Declaration iii

Acknowledgements iv

Table of Contents vi

List of Figures x

List of Tables xiii

Chapter 1 General introduction 1

1.1 References 5

Chapter 2 Review of *Guignardia citricarpa* Kiely, the causal agent of citrus black spot 10

2.1 The pathogen, *Guignardia citricarpa* 10

2.1.1 Origin and distribution of *Guignardia citricarpa* 10

2.1.2 *Guignardia* species on citrus 10

2.1.3 Morphology of *Guignardia citricarpa* 13

2.1.4 Sporulation 15

2.1.5 Spore germination 15

2.2 The host, *Citrus* 17

2.3 The disease, citrus black spot 18

2.3.1 Origin and distribution of citrus black spot 18

2.3.2 Economic importance of citrus black spot 19

2.3.3 Inoculum 19

2.3.3.1 Ascospores 19

2.3.3.2 Pycnidiospores 20

2.3.3.3 Symptomless infection 21

2.3.4 Infection 21

2.3.5 Symptoms 22

2.3.5.1 Fruit symptoms 23

2.3.5.1.1 Red spot 24

2.3.5.1.2 Hard spot 24

2.3.5.1.3 Freckle spot 25

2.3.5.1.4 Virulent spot 25

2.3.5.1.5 Speckled blotch 28
2.3.5.1.6 Cracked spot 28
2.3.5.2 Citrus tan spot 28
2.3.5.3 Leaf symptoms 28
2.3.5.4 Twig symptoms 29
2.3.6 Control 29
2.3.6.1 Chemical control 29
2.3.6.2 Non-chemical control 31
2.4 References 32

Chapter 3 Failure of *Phyllosticta citricarpa* pycnidiospores to infect Eureka lemon leaf litter 41
3.1 Abstract 41
3.2 Introduction 41
3.3 Materials and methods 43
3.3.1 Pure culture 44
3.3.2 Infected fruit 45
3.3.3 Peelings of infected fruit 47
3.3.4 Polymerase chain reaction 48
3.3.5 Ascospore capturing 48
3.4 Results 48
3.5 Discussion 51
3.6 References 53

Chapter 4 Susceptibility of citrus leaves to *Phyllosticta citricarpa* relative to leaf age and phenolic acid content 57
4.1 Abstract 57
4.2 Introduction 57
4.3 Materials and methods 59
4.3.1 Leaf inoculation 59
4.3.2 Extraction and quantification of phenolic acids 61
4.3.3 Statistical analysis 63
4.4 Results 63
4.5 Discussion 69
4.6 References 71

Chapter 5 Monitoring *Guignardia citricarpa* ascospores from citrus leaf litter in commercial orchards 76

5.1 Abstract 76
5.2 Introduction 76
5.3 Materials and methods 78
5.3.1 Evaluation of the Kotzé Inoculum Monitor 78
5.3.2 Rate of ascospore maturation and leaf decomposition 79
5.3.3 Ascospore capturing from naturally produced leaf litter 80
5.3.4 Statistical analysis 80
5.4 Results 81
5.4.1 Evaluation of the Kotzé Inoculum Monitor 81
5.4.2 Rate of pseudothecium maturation and leaf decomposition 81
5.4.3 Ascospore capturing from naturally produced leaf litter 83
5.5 Discussion 83
5.6 References 94

Chapter 6 Artificial wilting of symptomless green leaves to enhance detection of *Guignardia citricarpa* 97
6.1 Abstract 97
6.2 Introduction 97
6.3 Materials and methods 99
6.3.1 Optimisation of leaf wilting 99
6.3.2 Field samples 100
6.3.3 Microscopic examination 101
6.3.4 DNA extraction 101
6.3.5 PCR condition 101
6.3.6 Statistical analysis 104
6.4 Results 104
6.4.1 Optimisation of leaf wilting 104
6.4.2 Field samples 108
6.5 Discussion 117
6.6 References 119

Chapter 7 Leaf litter management as a non-chemical means of reducing citrus black spot 122
7.1 Abstract 122
7.2 Introduction 122
7.3 Materials and methods 124
7.4 Results 127
7.5 Discussion 128

7.6 References 135

Chapter 8 General discussion **138**

8.1 References 143

Appendix A Operational procedures of the Kotzé Inoculum Monitor 146

Appendix B Protocol to artificially wilt green citrus leaves to improve detection of *Guignardia citricarpa* in latently infected leaves 148

LIST OF FIGURES

Figure 2.1. Tear stain pattern of hard spot lesions on a mature Valencia orange fruit, typically formed from pycnidiospore infections of *Guignardia citricarpa*. 23

Figure 2.2. Red spot lesions caused by *Guignardia citricarpa* on mature Eureka lemon fruit. 26

Figure 2.3. Hard spot lesions caused by *Guignardia citricarpa* on a mature Eureka lemon fruit. 26

Figure 2.4. Freckled spot lesions caused by *Guignardia citricarpa* on a mature Eureka lemon fruit. 27

Figure 2.5. Virulent spot lesions caused by *Guignardia citricarpa* on a mature Eureka lemon fruit. 27

Figure 2.6. Lesions on Eureka lemon leaves caused by *Guignardia citricarpa*. 30

Figure 2.7. Fructification of *Guignardia citricarpa* on Eureka lemon leaf litter. 30

Figure 2.8. Lesions of *Guignardia citricarpa* on an infected Eureka lemon twig. 30

Figure 3.1 Valencia orange fruit with hard spots, tied to a grid containing mature, green, citrus black spot-free Eureka lemon leaves. 46

Figure 5.1. The Kotzé Inoculum Monitor illustrating the position of the prepared leaf grid in the hopper. (Courtesy of T.N. Janse van Rensburg). 79

Figure 5.2. Ascospores of *Guignardia citricarpa* collected from Eureka lemon leaf litter on silicone-coated microscope slide with the Kotzé Inoculum Monitor. 82

Figure 5.3. *Guignardia citricarpa* ascospores collected with the Kotzé Inoculum Monitor (KIM) from Eureka lemon and Valencia orange leaf litter. Total ascospore counts were done along the centre transect row (30 x 5 mm) in 25 mm^2 sections of a microscope slide coated with silicon. Each 25 mm^2 section correlates to ca. 20 minutes of KIM operation. 82

Figure 5.4. Mean maximum and minimum temperature and total rainfall per month recorded in Mooinooi in North West Province during September 2003 to March 2006. Data obtained from the South African Weather Service. 89

Figure 5.5. Mean maximum and minimum temperature and total rainfall per month recorded in Burgersford in Mpumalanga Province during September 2003 to March 2006. Data obtained from the South African Weather Service. 90

Figure 6.1. Green mature Eureka lemon leaves that were kept in closed bags for more than 15 hours remained too moist while some started to rot. A: leaves in a 20 µm thick bag, B: leaves in a 40 µm thick bag. 106

Figure 6.2. Green mature Eureka lemon leaves dried by direct sun light remained mainly green while becoming dry and brittle within 21 days. No *Guignardia*-like structures formed consequently. 106

Figure 6.3. Fruiting bodies of *Guignardia* spp. on artificially wilted mature Eureka lemon leaves after 7 (A) and 14 (B) days of treatment. 112

Figure 6.4 Leaf browning of treated mature green Eureka lemon (EL) and Valencia orange (VO) leaves expressed as frequency of leaves in each rating scale (0 to 4), 7, 14 and 21 days after wilting treatment commenced using 20 µm thick clear plastic bags. Leaf browning was scored on a five point ordinal scale as percentage of total leaf area, with 0 = 0%, 1 = 1-25%, 2 = 25-50%, 3 = 51-75% and 4 = 76-100%. Mean of four to eight replicates, each consisting of 20 leaves; bars do not differ significantly according to Students *t*-least significant difference ($P \leq 0.05$). 113

Figure 6.5. Formation of *Guignardia*-like fruiting structures on treated mature green Eureka lemon (EL) and Valencia orange (VO) leaves expressed as frequency of leaves in each scale (0 to 3); A=7, B=14 and C=21 days after wilting treatment commenced using 20 µm thick clear plastic bags. Scale of visual assessment of *Guignardia*-like fruiting structures as percentage of total leaf area, with 0 = 0%; 1 = 1-10%; 2 = 11-25% and 3 = >25%. Mean of four to eight replicates, each consisting of 20 leaves; bars followed by the same letter do not differ significantly according to Students *t*-least significant difference ($P \leq 0.05$). 114

Figure 6.6. PCR amplicons of *Guignardia citricarpa* and *Guignardia mangiferae* from DNA extracted from symptomless citrus leaves. 1 to 7 = green, un-wilted leaves, 1 = Valencia Orange (VO) from Burgersford, 2 = VO from Nelspruit, 3 = VO from Tzaneen, 4 = Eureka lemon (EL) from Paarl, 5 = VO from Mooinooi, 6 = EL from Mooinooi, 7 = EL from Pretoria. 8 to 14 = leaves wilted for seven consecutive days, 8 = VO from Nelspruit, 9 = EL from Mooinooi, 10 = VO from Mooinooi, 11 = VO from Tzaneen, 12 = VO from Burgersford, 13 = EL from Pretoria. 14 to 16 = leaves wilted for 14 consecutive days, 14 = VO from Nelspruit, 15 = VO from Tzaneen, 16 = EL from Pretoria. M = DNA marker Hyperladder IV (Bioline), GC = *Guignardia citricarpa* positive control, GM = *Guignardia mangiferae* positive control, Neg = negative control with no DNA added. 116

Figure 6.7. PCR amplicons of *Guignardia citricarpa* and *Guignardia mangiferae* from DNA extracted from symptomless artificially wilted citrus leaves. 1 to 6 = leaves wilted for seven consecutive days, 1 = Valencia Orange (VO) from Nelspruit, 2 = VO from Burgersford, 3 = VO from Tzaneen, 4 = Eureka lemon (EL) from Pretoria, 5 = EL from Mooinooi, 6 = VO from Mooinooi. 7 to 12 = leaves wilted for 14 consecutive days, 7 = VO from Nelspruit, 8 = VO from Burgersford, 9 = VO from Tzaneen, 10 = EL from

Pretoria, 11 = VO from Mooinooi, 12 = EL from Mooinooi. 13 to 16 = EL leaves from Pretoria wilted for 21 consecutive days, 13 = sample 1, 14 = sample 2, 15 = sample 3, 16 = sample 4. M = DNA marker Hyperladder IV (Bioline), GC = *Guignardia citricarpa* positive control, GM = *Guignardia mangiferae* positive control, Neg = negative control with no DNA added. 116

Figure 7.1. Rating used to evaluate level of fruit infection, where A: 0 = clean; B: 1 = 1-5 spots per fruit; C: 2 = 6-50 spots per fruit; D: 3 = > 50 spots per fruit. 126

Figure 7.2. Quest volumetric spore trap used to capture spores during October to February. 129

Figure 7.3. Layer of wheat straw mulch on the orchard floor at the end of the season (March). 129

Figure 7.4. Prevailing climatic conditions in Burgersford area, Mpumalanga, A: August 2001 to August 2003 and B: September 2003 to September 2005. 130

Figure A.1. Diagrammatic cross-section of the Kotzé Inoculum Monitor unit. A: grid support for plant material in hopper; B: evacuator motor unit; C: water trap with overflow water tray; D: air orifice; E: low-pressure chamber; F: carrier for Petri dish or microscope slide. 147

Figure A.2. Diagrammatic cross-section of the front view of the low-pressure chamber to illustrate position of microscope slide (I) and Petri dish (II). A: gravity catch; B: microscope slide; C: orifice (behind the slide or dish); D: slide support pin; E: Petri dish; F: carrier bracket. 147

LIST OF TABLES

Table 2.1. Characteristics differing between *Guignardia citricarpa* and *Guignardia mangiferae* 12

Table 3.1. Presence of *Guignardia citricarpa* or *Guignardia mangiferae* on black spot free Eureka lemon leaves after exposure to pycnidiospores under controlled conditions (growth chambers) and in the field 50

Table 4.1. Reisolation frequency (RF) of *Phyllostica citricarpa* from Eureka lemon and Valencia orange leaves artificially inoculated at advancing states of development with pycnidiospore suspension of the pathogen 65

Table 4.2. Reisolation frequency (RF) of *Phyllostica citricarpa* over a period of six months from Eureka lemon and Valencia orange leaves artificially inoculated with a pycnidiospore suspension of the pathogen when one to four months old 66

Table 4.3. Soluble and cell-wall bound phenolic compounds in Valencia orange leaves artificially inoculated or not inoculated at advancing stages of development with a pycnidiospore suspension of *Phyllosticta citricarpa* 67

Table 5.1. *Guignardia citricarpa* ascospores collected with the Kotzé Inoculum Monitor from Eureka lemon and Valencia orange leaf litter 84

Table 5.2. Leaf decomposition level (%) of Eureka lemon leaves detached monthly and exposed to the environmental conditions in an orchard near Mooinooi in North West Province for one to six months 85

Table 5.3. Leaf decomposition level (%) of Valencia orange leaves detached monthly and exposed to the environmental conditions in an orchard near Burgersfort in Mpumalanga Province for one to six months 87

Table 5.4. Number of ascospores captured with the Kotzé Inoculum Monitor from naturally produced leaf litter collected monthly from the orchard floor 91

Table 6.1. Treatments applied for 21 days on mature green Eureka lemon leaves during optimisation of leaf wilting process 102

Table 6.2. State of mature green Eureka lemon leaves, collected in Mooinooi, North-West Province, 21 days after leaf wilting treatment commenced using 20 µm thick clear plastic bags during optimisation of the leaf wilting process 105

Table 6.3. State of mature green Eureka lemon leaves, collected in Mooinooi, North-West Province, 21 days after leaf wilting treatment commenced using 40 µm clear plastic bags during initial optimisation of the leaf wilting process 109

Table 6.4. Formation of *Guignardia*-like fruiting structures on treated mature green Eureka lemon leaves collected in Mooinooi, North-West Province, expressed as

frequency of leaves in each rating scale (0 to 3), 10 and 21 days after wilting treatment commenced using 20 µm thick clear plastic bags 110

Table 6.5. Leaf browning of treated mature green Eureka lemon leaves collected in Mooinooi, North-West Province, expressed as frequency of leaves in each rating scale (0 to 4), 10 and 21 days after wilting treatment commenced using 20 µm thick clear plastic bags 111

Table 6.6. Detection of *Guignardia citricarpa* in naturally infected green symptomless citrus leaves before and 7, 14 and 21 days after wilting treatment commenced using primer set CITRIC1 and ITS4 (amplicon 580 bp) 115

Table 7.1. Incidence and severity of citrus black spot in a commercial Valencia orange orchard where leaf litter was either left undisturbed (control), removed or removed together with mulching with wheat straw 131

Table 7.2. Vertical and horizontal distribution of citrus black spot-infected fruit in trees in a commercial Valencia orange orchard from which leaf litter was either left undisturbed, removed or removed together with mulching with wheat straw 132

Table 7.3. Aspectual distribution of citrus black spot-infected fruit in trees in a commercial Valencia orange orchard from which leaf litter was either left undisturbed, removed or removed together with mulching with wheat straw 133