QUARANTINE STATUS OF SELECTED FUNGAL PATHOGENS ON *MALUS*, *PRUNUS* AND *VITIS* SPECIES

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DECLARATION

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and has not previously in its entirety or in part been submitted at any university for a degree.

Signature:

Date: 10.03.06

SUMMARY

QUARANTINE STATUS OF SELECTED FUNGAL PATHOGENS ON *MALUS*, *PRUNUS* AND *VITIS* SPECIES

Invasions of alien species into non-native environments pose one of the largest, but least addressed international threats to biodiversity, both within natural ecosystems and agricultural settings. It is without exception ranked as the greatest environmental threat of the 21st century. Their introduction and spread have been identified as one of the six major categories of change that could potentially alter the world's biodiversity. The number and variety of species introduced make it clear that it is no exaggeration to state that biological invasions are breaking down biogeographic barriers that created and maintained the major floral and faunal regions of Earth. It is, however, difficult to conceive that a single indicator could measure the impact of an invader on a country due to the difficulty in measuring their environmental as well as their financial impacts. Another contributing factor to this problem is the scarcity of data available on the impact of the thousands of invaders in other countries.

For the agricultural sectors, alien invasive species are likened to a two-edged sword: on the one hand they are used in the development of new plant varieties and products and on the other hand they have the potential to threaten agricultural production and as a consequence agricultural economic development. An important challenge for countries lies in the development of improved protocols for the prevention, identification and managing of potential invasive alien species.

Plant health has always influenced international trade and the backbone for non-discriminatory, fair, predictable and transparent international trade is the set of rules that national governments have agreed to follow with the foundation of the World Trade Organisation (WTO) in 1995. With the establishment of the WTO, the "WTO - Agreement on the Application of Sanitary and Phytosanitary measures (WTO-SPS)" also came into force. This agreement lays out the provisions, rights and obligations of countries in setting measures to protect human, animal and plant life and health. It also guides quarantine policy and decision-making, with the objective to prevent the use of quarantine measures by governments as disguised or unjustified trade barriers to protect their agricultural industries from import competition.

As a signatory member of the WTO-SPS, South Africa has the right to implement appropriate measures to protect our plant health and environment. To set the appropriate levels for protection, South Africa must either apply to international standards or undertake a scientific based risk analysis process, to justify quarantine measures. These measures must also be the minimum necessary to protect plant health. A key element in negotiations for market access is the provision of a list of regulated pests, as well as a list of all pests associated with the crop within the exporting country, to the trading partners. In this study lists of fungal pathogens associated with *Malus* spp. and *Vitis* spp. worldwide, including South Africa, were compiled to enable the National Plant Protection Organisation in South Africa to comply with their responsibilities as a signatory member of the international regulatory bodies and to assist them to safeguard our country against harmful invasive species. It was concluded that to have access to accurate plant health status information, all researchers are summoned to validate new pest records and to submit voucher specimen to our National Collection.

Geographical distribution records of pathogens and pests are the basis for phytosanitary decision-making and therefore it is imperative for countries to have access to accurate information regarding the geographical distribution of pathogens within their boundaries. For a pathogen to be classified as an A1-pest, the pest should be of economic importance to the endangered area and not yet present there or present, but not widely distributed and being officially controlled. Many disputes have arisen during the past years concerning the classification for *Monilinia fructicola* and *Neonectria galligena* as A1-regulated pests for South Africa, due to official records of the presence of these pathogens dating back as early as 1917. The situation was further complicated by recent reports from some European countries that *M. fructicola* was detected on stone fruit imported from South Africa. These issues were resolved in this study by following a molecular approach and guidelines as stipulated by the international regulatory bodies. The absence of *M. fructicola* as well as *N. galligena* from South African stone and pome fruit orchards was confirmed. The regulated status of *M. fructicola* and *N. galligena* in South Africa is therefore scientifically justified.

OPSOMMING

KWARANTYNSTATUS VAN GESELEKTEERDE SWAMPATOGENE OP *MALUS*, *PRUNUS* EN *VITIS* SPESIES

Die inbring van vreemde, skadelike spesies bedreig biodiversiteit binne natuurlike ekosisteme en landbou-omgewings. Hierdie aspek, wat ongelukkig nie die steun of aandag geniet wat dit verdien nie, word sonder uitsondering gereken as dié bedreiging vir die omgewing van die 21ste eeu. Die inbring en verspreiding van hierdie spesies is ook reeds geïdentifiseer as een van die ses belangrikste potensiële faktore wat tot verandering in die wêreld se biodiversiteit kan lei. Statistieke van die aantal en verskeidenheid spesies wat reeds nuwe omgewings suksesvol binnegedring het, is 'n duidelike bewys dat dit geen oordrywing is dat hierdie verskynsels afbreek maak aan bio-geografiese grense nie, wat tot die ontstaan en instandhouding van die wêreld se vernaamste plantegroei- en dierelewestreke gelei het. Die moeilikheidsgraad verbonde aan die bepaling van die impak wat hierdie spesies op omgewings en ekonomieë het, maak dit onmoontlik om 'n enkele indikator te bepaal om hierdie impakte te meet. 'n Verdere bydraende faktor tot hierdie probleem, is die gebrek aan beskikbare data oor die impak wat die menigte van spesies op ander lande gehad het.

Hierdie vreemde spesies is vir die landbousektor soos 'n tweesnydende swaard: enersyds word dit benodig vir die ontwikkeling en teling van nuwe kultivars en produkte, en andersyds beskik hul oor die potensiaal om bedreigings vir landbou, en gevolglik ook vir landbou-ekonomiese ontwikkeling, in te hou. Die uitdaging lê dus daarin vir lande om riglyne daar te stel en te ontwikkel vir die voorkoming, identifikasie en bestuur van vreemde en potensieel skadelike spesies.

Internasionale handel is nog altyd deur die fitosanitêre status van plante beïnvloed. Die grondbeginsels vir nie-diskriminerende, regverdige, voorspelbare en deursigtige internasionale handel word saamgevat in die stel reëls wat nasionale regerings ooreengekom het om te volg met die stigting van die Wêreldhandelsorganisasie (WHO) in 1995. Tesame met die stigting van die WHO het die "WTO – Agreement on the Application of Sanitary and Phytosanitary measures" (WTO-SPS) ook van krag geword. Die doel van hierdie ooreenkoms is om riglyne neer te lê waarbinne lande moet optree met die daarstelling van maatreëls om mens, dier en plant te beskerm. Dit verskaf ook riglyne vir kwarantynmaatreëls en -beleide om sodoende te voorkom dat lande kwarantynmaatreëls kan gebruik as onregverdige handelsbeperkinge om hul eie industrieë teen kompetisie te beskerm.

As ’n ondertekenaar van die WTO-SPS, beskik Suid-Afrika oor die reg om toepaslike maatreëls te implementeer om ons plante en omgewing te beskerm. Om hierdie maatreëls te bepaal, moet Suid-Afrika egter aan internasionale standaarde voldoen of risiko-bepalings uitvoer wat op wetenskaplike beginsels gebaseer is. Hierdie maatreëls moet ook die minimum wees wat nodig is om plantgesondheid in Suid-Afrika te beskerm. ’n Sleutelfaktor in die onderhandelingsprosesse vir marktoegang, is die voorsiening van ’n lys van beheerde peste aan die invoerland, asook ’n lys van alle peste en plae wat in die uitvoerland met die gewas geassosieer word, aan die invoerland. In hierdie studie is lyste saamgestel van swampatogene wat wêreldwyd met *Malus* en *Vitis* spp. geassosieer word, insluitende Suid-Afrika. Die doelstelling van die lyste is om die Nasionale Plantbeskermingsorganisasie van Suid-Afrika in staat te stel om hul verantwoordelikhede as ondertekenaar van internasionale ooreenkomste na te kom en sodoende ook ons land teen vreemde en potensieel skadelike spesies te beskerm. Hierdie lyste bied akkurate inligting rakende plantgesondheidstatus in Suid-Afrika, maar dien ook as werksdokumente vir navorsers wat rekords van nuwe peste moet valideer en ook kulture as bewysstukke in ons Nasionale Versamelings deponeer.

Geografiese verspreidingsrekords van patogene en peste vorm die basis van fitosanitêre besluitneming en dit is dus noodsaaklik vir lande om toegang te hê tot akkurate inligting met betrekking tot die geografiese verspreiding van patogene binne hul landsgrense. Vir ’n patogeen om as ’n A1-pes geklassifiseer te word, moet die pes van ekonomiese belang wees vir die bedreigde area en nog nie daar voorkom nie, óf voorkom, maar wel nie wyd-verspreid nie en amptelik onder beheer is. Verskeie dispute het gedurende die afgelope jare ontstaan rakende die klassifikasie van *Monilinia fructicola* en *Neonectria galligena* as A1-peste vir Suid-Afrika as gevolg van amptelike rekords wat vanuit 1917 dateer dat hierdie patogene wel in Suid-Afrika teenwoordig is. Die situasie is verder vererger deur onlangse verslae van Europese lande dat *M. fructicola* op steenvrugte wat vanuit Suid-Afrika ingevoer is, ontdek is. Hierdie probleemgevalle is in hierdie studie aangespreek deur ’n molekulêre benadering en riglyne, gebaseer op internasionale standaarde, te volg. Die afwesigheid van *M. fructicola* en *N. galligena* in Suid-Afrikaanse kern- en steenvrugteboorde is bevestig. Die klassifikasie van *M. fructicola* en *N. galligena* as A1- peste vir Suid-Afrika is dus wetenskaplik geregverdig.

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CONTENTS

1. INVASIVE ALIEN SPECIES, AGRICULTURE, GLOBAL TRADE AND INTERNATIONAL RULES AND REGULATIONS

INTRODUCTION

Invasions by plants, animals, pests and diseases (invasive alien species) into non-native environments pose one of the largest, but least addressed international threats to biodiversity, both within natural ecosystems and agricultural settings. Invasive alien species are ranked without any exception as the greatest environmental threat of the 21st century (Scherm and Coakley, 2003). Their introduction and spread has been identified as one of the six major categories of change that could potentially alter the world's biodiversity (Lovel, 1997; Vitousek *et al.*, 1997; Carlton, 1998; Ruiz *et al.*, 1999; Kolar and Lodge, 2000; Carruthers, 2003). Although not always apparent or measurable, the largest risk posed by introduced species may well be their contribution to global homogenisation (McNeely, 2000). The impacts of these invaders are primarily local and national, but the root causes of their spread, driven by global trade, transport, travel and tourism, are regional as well as international (Bright, 1999; Clement, 2002; Levine and D'Antoino, 2003). The future is certain to bring considerable additional ecological shuffling as humans interfere and influence ecosystems in various ways. This shuffling will have both winners and losers, although the overall effect will likely be a global loss of biodiversity at species and genetic level.

WHAT IS AN INVASIVE ALIEN SPECIES?

An invasive alien species can be defined as a non-native species that has been introduced into an area, either accidentally or intentionally, outside of where it naturally occurs, which threatens or has the potential to threaten valued environmental, agricultural or personal resources by the damages caused (Lodge, 1993; Williamson, 1996; Anon, 2005a, 2005b). Many different names have been given to these organisms such as invaders, biological invasions, exotics, aliens, introduced species, non-indigenous species, non-native or adventitious species (Mooney and Hobbs, 2000).

Invasive alien species can occur in all habitats. The reasons for their success as creators of such serious problems in their new environments are the absence of natural enemies and the lack of host resistance genes (Torchin *et al.*, 2003).

HISTORY OF INTRODUCTIONS

People have been and will always be travelling, taking different species with them for a number of reasons. Levin (1989) concluded that three main categories of introductions existed, namely accidental introductions (often invertebrates and pathogens), species imported for a specific purpose that escape, and deliberate introductions (usually plants and vertebrates). In most of these cases deliberate introductions relate to the human interest in species that encourage growth and development. In most parts of the world, the greater bulk of human dietary needs are met by the species that have been introduced from elsewhere (Hoyt, 1992; Pimental *et al.*, 2000); it will be very difficult today to imagine an African continent without cattle, maize, goats and cassava, which are all introduced plant and animal species (Anon, 2005c).

In some cases the impact of these first colonialists had devastating effects on the local ecosystem (Martin and Klein, 1984), for example the spread of cattle through much of Africa during the past thousand years has brought other associated new diseases such as "Rinderpest" (cattle plague) in 1887 (Scott, 2000). All attempts to stop this disease by means of proclamations, fences and slaughtering of sick animals failed. In the pace of ten years the disease reached the Cape Colony (Henning, 1956). Rinderpest caused ruin and devastation over extensive stretches of the African continent, destroying not only the majority of domestic bovines, but also substantial numbers of indigenous antelope. In South Africa alone the estimated number of cattle that succumbed to this disease was more than two and a half million.

Many other introductions are due to unintentional 'hitchhiking' (accidental introductions) through international trade. Invaders stowed away in ships, planes, trucks, shipping containers and packing material or arriving on nursery stock, unprocessed logs, fruits, seeds and vegetables (OTA, 1993). In 2004, Gonthier *et al.* has reported the introduction of *Heterobasidium annosum* from eastern North America into the Presidential Estate of Castelporziana, near Rome in Italy on wooden transport crates. These crates were shipped to the 5th USA army, who occupied the grounds during World War II. The origin of these isolates was traced back to the USA based on a unique insertion in the mitochondrial ribosomal operon of this species.

It is not an easy task to determine how much of the invasive problem world-wide is due to deliberate intent and how much to inadvertence, but some hints are available: the Office of Technology Assessment (OTA) concluded in 1993 that about 4 500 exotic species occur in a free ranging condition in the United States, and that about 20% of them have caused serious economic or ecological harm. More recently, Pimental *et al.* (2000, 2005) claimed that approximately 50 000 species were estimated to have been introduced into the United States. Carlton (1999) estimated that about 10 000 or more species may be transported daily around the world in the ballast water of ships. Information from Australia revealed that in 2001, some 25 mammals, 20 birds, 4 reptiles, one amphibian and at least 23 freshwater fish species were introduced and established in Australia, along with about 2 000 plants (Australian Bureau of Statistics, 2002).

GLOBAL TRADE AND THE MOVEMENT OF INVASIVE ALIEN SPECIES

People around the globe are more connected with each other than ever before. Goods and services produced in one part of the world are increasingly available in the rest of the world. International travel is more frequent and international communication is commonplace. This phenomenon, titled "globalisation", offers extensive opportunities for worldwide development and is warmly welcomed by many people. The pace of this phenomenon is primarily driven by four forces (i) improvement in technology, (ii) lowering of trade barriers, (iii) capital flows and (iv) the questioning human spirit (Mooney and Hobbs, 2000).

A generally unrecognised side-effect of the openness of an economy (its integration with the rest of the world) and the composition of its trade flows is the introduction of exotic species, some of them invasive alien species (Dalmazzone, 2000; McNeely, 2000). Therefore globalisation has both positive and negative sides, with alien invasive species being negative (Erserink, 1999; Perrings *et al.*, 2000).

Invasive species can move in mysterious ways, and therefore routes of entry for pests on living plants can easily be overlooked (Welliver, 2003). The routes can be on living plants that appear healthy and pathogen-free, and also on untreated or improperly treated manufactured items that contain plant-derived components. Sometimes a pathogen that has a severe and obvious effect on one host is nearly invisible on another. With the variety of plant materials shipped globally, there are many relatively uncommon hosts – hosts that have a relatively small niche in the plant trade. Many hosts may easily harbour pathogens that are not known to occur on that host, for example the quarantine disease, *Arabis mosaic virus* and the healthy, beautiful, variegated vinca vine (Welliver, 2003). This destructive disease of grapevines and fruit trees is widely prevalent in this host, but no obvious symptoms are visible. The prevention of the entry of invasive species on manufactured goods is very difficult. Sometimes, these organisms are merely 'hitchhiking' on the cargo and sometimes they are not associated with the goods being imported, but simply contaminated the packing materials used routinely for shipment of cargo. Between 1995 and 1998, 97% of the potential forest pests detected in the United States (US) by border inspectors of the United States Department of Agriculture were found on solid wood packing material (USDA APHIS and Forest Service, 2000). An Australian study showed that empty sea cargo containers could contain some live as well as many dead pests (Stanaway *et al.*, 2001). In order to reduce the risks of introduction and/or spreading of serious harmful organisms with wood packaging material used in international trade, an International Standard for Phytosanitary Measures (ISPM) – "ISPM 15 – Guidelines for regulating wood packaging material in international trade", was published in 2002 by the Food and Agriculture Organisation of the United States (FAO, 2002).

Soil movement can also introduce new plant pathogens and noxious weeds (Welliver, 2003). These movements may be deliberate, such as a shipment of topsoil or potting soil, but it may also be the "dirt" contaminating equipment and cargo. It is relatively easy to regulate deliberate soil movement, but regulating dirt and grime is a monumental task.

Lag time is another important and under-appreciated factor of invasion biology. There are many non-native insect and disease problems in countries that first went unnoticed but became problematic with time. Sudden oak disease (*Phytophthora ramorum*) is suspected to have been present in Europe since 1993 on *Rhododendron* and *Viburnum*. The pathogen, however, was not identified until 2001 (NAPPO, 2003). This disastrous disease was first seen in California in 1995, where it is reported to kill healthy trees in four months time (Kliejunas, 2001). Armillaria root rot of Proteaceae in South Africa is another example of a disease that went unnoticed but became problematic with time (Crous, 2005; Crous and Groenewald, 2005). The disease was found recently in indigenous Proteaceae in the Kirtenbosch Botanical Gardens of South Africa (Denman *et al.*, 2000). Restriction fragment length polymorphism (RFLP) profiles indicated that the two *Armillaria* species isolated from the diseased plants did not represent African taxa but taxa native to the Northern Hemisphere. Coetzee *et al.* (2001) proved that the *Armillaria mellea* s.str, a fungus restricted to the Northern Hemisphere, was introduced into the Dutch East India Company Gardens situated in the centre of Cape Town, approximately 300 years ago, most probably via citrus plants from Europe. Coetzee *et al.* (2003) has indicated that the second *Armillaria* species found was representative of *Armillaria gallica*, also native to the Northern Hemisphere. The spread of these fungi, which were probably introduced several hundred years ago into South Africa, from the centre of Cape Town to the foot of Table Mountain poses a serious threat to South Africa's indigenous Proteaceae.

The introduction of new genotypes into areas where there are indigenous genotypes of the same species has increased the likelihood of encounters between these related but previously geographically separated species. Subsequent hybridisation between the invader and the resident species can result in interspecific gene flow, which can lead to single gene transfers such as pathogenicity or to the evolution of new hybrid species with novel host ranges, or both (Brasier 2000, 2001). For example, on poplar, the hybridisation between the allopatric *Melampsora* spp. has resulted in a new hybrid species with combined host ranges of the two parents (Newcombe *et al.*, 2000). In the Netherlands, a new species of *Phytophthora* was reported by Man in't Veldt *et al.* (1998) on *Primula* and *Spathiphyllum*, which was actually a hybrid between *Phytophthora cactorum* (native species) and *Phytophthora nicotianae* (an introduced species). In South Africa, induced sexual matings between the spot and net type of *Pyrenophora teres,* causative agent of net blotch of barley, resulted in progeny that were found to be able to infect cultivars that were usually only susceptible to the net-type as well as those only susceptible to the spot type (Campbell and Crous, 2003).

CONSEQUENCES AND EXAMPLES OF INTRODUCTIONS OF INVASIVE ALIEN SPECIES WITH SPECIAL REFERENCE TO SOUTH AFRICA

The number and variety of species introduced make it clear that it is no exaggeration to state that biological invasions are breaking down biogeographic barriers that created and maintained the major floral and faunal regions of Earth (Vitousek *et al.*, 1997). It is difficult to conceive that a single indicator could measure the impact of an invader on a country due to the difficulty in measuring their environmental as well as their financial costs. Another contributing factor to this problem is the little data that is available on the impact that many of the thousands of invaders have had in countries. Also, many types of damage can be attributed to natural and managed ecosystems such as degrading of human health (Craven *et al.*, 1988), human wealth (FAO, 1989), altering of ecosystem processes (Vitousek and Walker, 1989; Vitousek *et al.*, 1996) and interactions of other global changes such as land use change and extinctions/loss of biological diversity (Hobbs and Huenneke, 1992; Vitousek, 1994). In the case of South Africa, all aspects of the natural resource economy of the country such as agriculture, forestry and water supplies as well as the unique natural ecosystems are also under serious attack by invasive alien species since the country's earliest exposure to communication with the rest of the global world (Macdonald *et al.*, 1986). Many examples of South African ecosystems that had been been affected by invasive alien organisms from most of the major taxonomic groups (Richardson *et al.*, 2000) exits. Some of these introductions also resulted in major ecological and economical damages and losses.

History and records show that exotic plant pests and pathogens, that have had profound effects on South Africa's agriculture, were introduced into South Africa as early as 1873 and 1886 when the cottony cushion scale (*Icerya purchasi*) and grapevine phylloxera (*Viteus vitifolia*) were respectively detected for the first time in South Africa (De Klerk, 1974). Over the last decades, with the ever-increasing global movement of people and goods, the threat of introducing exotic plant pests and pathogens to South Africa has increased. The golden cyst nematode (*Globodera rostochiensis*) was first reported in 1971 and was subsequently eradicated but was again found in the Western Cape in 1999 (Knoetze *et al*., 2004). The Russian wheat aphid, *Diuraphis noxia*, invaded South Africa in 1979 with disastrous effects on the wheat industries. In 1982, *Liriomysa trifolii* (leaf miner) was detected for the first time in South Africa as well as *Cydia molesta* (Oriental fruit moth) in March 1990 (Anon., 1990). The Mediterranean snail, *Otala lactea*, was first discovered in the Cape Town docks and in Bellville in the Western Cape Province during 1986 and 1987. A very intensive control programme was launched that successfully eradicated the pest. Intensive surveys between 1989 and 1992 yielded no trace of the pest (Walters and Walters, 1991). In 1996, the stripe rust pathogen, *Puccinia striiformis* f. sp. *tritici* was introduced into South Africa (Boshoff *et al*., 2002) and in 1999 the larger grain borer, *Prostephanus truncates*, an insect that destroys maize, cassava and other grains was detected on the northern borders of the Kruger National Park (Hanekom, 1999). The Karnal bunt fungus, *Tilletia indica*, was found in the Douglas irrigation area in the Northern Cape during 2000 (Crous *et al*., 2001) and soybean rust (*Phakopsora pachyrhizi*) was also detected in 2001 (Pretorius *et al*., 2001).

Many exotic forest pathogens were also introduced to South Africa. In 1991, it was pitch canker (*Fusarium circinatum*) of mature pines (Wingfield *et al*., 2002), in 1994 it was the European wood wasp, *Sirex noctilio* (Tribe and Cillie, 2004) and the wood decay fungus *Amylosterum areolatum* (Wingfield *et al*., 2001), and in 1995 the sawfly, *Nematus oligospilus* Foerster (Urban and Eardley, 1995). Eight years after the first discovering of the European wood wasp, *S. noctilio*, in South Africa, this pest has spread up to 380 km along both the western and southern coasts. In order to control this pest, Forestry South Africa has approved millions of rands for control strategies (P.W. Crous, pers. comm.). The aggressive European wasp (*Vespula germanica*) was detected in the Kirstenbosch Botanical Gardens in 1974 (Tribe and Richardson, 1994). This insect can attack and destroy beehives and injure people, which may have major implications for the tourist industry in South Africa. Varroa mites (*Varroa jacobsoni* and *V. destructor*) were probably brought into South Africa from Asia by the advertent introduction of the tiny mites on illegally smuggled queen bees (Johannsmeier, 2002).

Versfeld *et al.* (1998) and Le Maitre *et al.* (2002) claim that about 180 species of invading alien plants cover 8% of South Africa's surface area, and about 7% of the annual flow of rivers is lost due to excessive use of water by alien woody invaders. The prickly pear (*Opuntia ficus-indica*) invasion of the early 1700s was one of the worst agricultural catastrophes in South Africa's history. Farm productivity was seriously impeded by the rapid invasion by this cactus, reaching about 900 000 hectare in 1942. Apart from abandoning of farmlands, serious stock losses also occurred due to injuries (Du Toit, 1942; Annecke and Moran, 1978; Zimmerman and Moran, 1991).

In the middle of the 19th century a number of woody plants, such as *Acacia saligna*, were introduced from Australia into South Africa as sources of fast-growing timber in the relatively treeless landscape as hedge plants, firewood, agents for binding the shifting dunes along the coast and ornamental plants. In the beginning, it appeared as an economically successful invasion within the greater Cape Town region alone, supporting a 30 million rand charcoal and firewood industry. As time went by, it was clear that the endemic Cape fynbos flora was becoming under serious threat. Watersheds of the Western Cape Province were becoming less productive and fire intensities increased on the slopes of Table Mountain (Van Wilgen *et al.*, 1996). This is a perfect example of an exotic species introduced for economic purposes, with unexpected negative results.

Several outbreaks of livestock diseases were also recently reported in South Africa. Foot-and-mouth disease and African horse sickness were reported in 2003, avian flu in 2004 and swine fever in 2005 (Anon, 2005c).

SOLUTIONS TO THE PROBLEM

It is easy to become very pessimistic about dealing with the challenges of invasive alien species but good science, adequate resources and proper tools can win the day. The resolve to develop the necessary tools and resources needed to deal with these organisms is becoming more widespread. Without the aid of molecular tools, plant pathologists would not be able to identify pathogens correctly, especially in cases where species previously believed to represent single taxa are now known to comprise more than one and sometimes large numbers of species. For example, the genus *Phomopsis* contains more than 800 species, most of which are recorded as plant pathogens of various plant species. As in the case of *Cercospora*, species of *Phomopsis* have mainly been based on host affinity. However, recent studies have shown that various species can infect a wide variety of hosts (Mostert *et al.*, 2001; Crous and Groenwald, 2005) and that host association is no longer sufficient for identification purposes. In a recent study by Van Niekerk *et al.* (2005), 15 species were identified from grapevine. These included species that were previously reported from *Prunus*, *Pyrus*, *Protea*, *Rosa* and *Helianthus annuus* (sunflowers). These findings effectively mean that strains can only be identified to species level with the aid of advanced molecular techniques.

The solution to address this global problem are relatively straight-forward and basically entail the following: prevent entry, have early warning systems in place, empowered phytosanitary diagnosticians to identify invasions correctly (Crous, 2005), prioritise actions for management, have monitoring systems in place, educate people (awareness) and also hold people accountable (Bradnock, 1995; Merriman *et al.*, 2001; Devorshak 2002; Burgess, 2003; Pimental *et al.*, 2005).

CAPACITY BUILDING AND EDUCATION

Building the necessary capacity, both in institutional and human resources, is crucial for effective management and prevention of these invaders. Internationally, the Global

Invasive Species Programme and the Global Environment Facility are working together through the United Nations Environment Programme to help build this capacity. The New Programme for Africa's Development (NEPAD) on Invasive Alien Species will have a strong focus on capacity building through Africa. South Africa is the focal point for this programme, leading the multi-country task team who will be working in conjunction with the international programmes (Invasive Alien Species – A Challenge to NEPAD 2004) (NEPAD, 2004).

For most people the problems with alien invaders are largely "out of sight, out of mind". To be successful in this ongoing battle against the spread of exotic plant pathogens as global markets will continue to expand, the formation of partnerships between all role players in South Africa (governments, universities, industries, and research facilities) is a necessity. These partnerships will allow for better communication, better management, better development, better awareness programs and better implementation of more effective exotic pest detection and control/eradication programs and will prevent duplication of efforts.

INTERNATIONAL RULES AND REGULATIONS TO PROVIDE BIOSECURITY FOR AGRICULTURE

For the agricultural sectors, alien invasive species are likened to a two-edged sword. On the one hand they are used in the development of new varieties and products and on the other hand they have the potential to threaten our biological diversity, agricultural production, the status of our natural resources and as a consequence agricultural economic development. An important challenge for countries lies in the development of improved protocols for the prevention, identification and managing of potential invasive alien species.

Biosecurity describes the concept and process of managing biological risks associated with food and agriculture and is composed of three sectors, namely food safety, plant health and animal health (Burgess, 2003). These sectors include food production in relation to food safety, the introduction of plant pests, animal pests and disease, and the introduction and safe management of invasive alien species and genotypes. Biosecurity is emerging as one of the most important issues facing the international community and thus has direct relevance to sustainable agriculture. The main factors that have increased the threat of the introduction of exotic plant pests and diseases are trade liberalisation, which resulted in much wider movement of people, plants, animals and their products (Margolis *et al.*, 2005).

Protecting the health of crops is becoming an increasingly important and difficult task. Quarantine and inspections of many countries are severely strained by this phenomenon.

INTERNATIONAL AGREEMENTS

After years of trade negotiations, the World Trade Organisation (WTO) was established in 1995, with a treaty on Sanitary and Phytosanitary measures (WTO, 1998). The treaty is managed by The United Nations Food and Agriculture Organisation, which is responsible for implementing the International Plant Protection Convention (IPPC) (FAO, 1997). However, countries cannot protect themselves from a pest unless they can clearly establish that a specific, credible threat exists through a risk assessment process. Also, a country can require only minimum treatment measures documented as effective in reducing risk. This process is clearly geared towards facilitating free trade at the expense of agricultural and environmental concerns. Thus given the extent and speed of trade, these agreements prevent nations from protecting their borders from new introductions of harmful species. An effort to prevent the international spread of harmful organisms came into effect during a conference of the United Nations' Food and Agricultural Organisation in 1951 where the IPPC was approved.

The IPPC is a multilateral convention adopted in 1952 with the purpose of securing international cooperation in the control and prevention of the spread and introduction of harmful organisms of plants and plant products and to promote appropriate measures for their control. Under the IPPC, the understanding of plant protection has been and continues to be broad, encompassing the protection of cultivated and non-cultivated plants from direct and indirect injury by harmful organisms. The Convention also extends to the protection of natural flora and plant products. It also includes both direct and indirect damage by harmful organisms, thus including weeds. The provisions further extend to cover conveyances, containers, storage places, soil and other objects or material capable of harbouring plant pests.

Activities addressed by the IPPC include the development and establishment of international plant health standards, the harmonisation of phytosanitary activities through emerging standards, the facilitation of exchange of official and scientific information among countries and the furnishing of technical assistance to developing countries that are signatories to the IPPC. The WTO recognised the IPPC as the standard-setting body for international plant quarantine issues. At the international level, the IPPC is implemented by national plant protection organisations in cooperation with regional plant protection organisations, the Interim Commission on Phytosanitary Matters (ICPM) and the Secretariat of the IPPC. Plant quarantine officials, whose primary objective is to safeguard plant resources from injurious pests, administer the IPPC at national level.

The signing of the 1995 WTO Agreement on the application of Sanitary and Phytosanitary Measures Agreement (SPS-Agreement) placed more rigorous requirements on international phytosanitary regulations (WTO, 1994). Phytosanitary regulations are those regulations of imported and exported commodities designed to protect plant health. Based on this international agreement, individual countries may enforce these regulations domestically, regionally by groups of countries or world-wide. The SPS-Agreement indicated that all countries are to base their phytosanitary measures on relevant standards, guidelines and recommendations developed under the auspices of the IPPC.

WORLD TRADE ORGANISATION (WTO)

The WTO is the only global international organisation dealing with the rules of trade between nations. The WTO-agreements are negotiated and signed by the bulk of the world's trading nations and ratified in their parliaments. The goal of these agreements is to help producers of goods and services, exporters and importers to conduct their business.

The WTO is located in Geneva, Switzerland and was established on the 1st of January 1995 by the Uruguay Round Multilateral negotiations and has 146 countries as members. The functions of the WTO is to administer WTO agreements and is a forum for trade negotiations, to handle trade disputes, to monitor national trade policies, to provide technical assistance and training for developing countries and to cooperate with other international organisations.

Both the Technical Barriers to Trade Agreement (TBT Agreement) and the Agreement on the Application of Sanitary and Phytosanitary Measures came into force with the establishment of the WTO.

TECHNICAL BARRIERS TO TRADE AGREEMENT (TBT AGREEMENT)

The objective of this agreement, resulting from the Uruguay Round of Multilateral Negotiations, is to prevent the use of national or regional technical requirements as unjustified technical barriers to trade (WTO, 1999). In that context, however, it recognises that each country should not be prevented from taking measures necessary to protect human, animal and plant health and/or the environment, and that each country has the right to set the level of protection that it deems appropriate in these areas (WTO, 1999). The Agreement encourages countries to use international standards where these are available, but it does not require countries to harmonise their domestic regulations and standards upwards or downwards as a result of international standardisation activities.

This Agreement covers all types of consumer products and any existing standards including quality requirements for foods. It does not, however, apply to requirements that are related to sanitary and phytosanitary measures. The latter are adopted by most countries to protect their domestic agricultural production and animal life from pests that may be brought into the country by imported products.

THE AGREEMENT ON THE APPLICATION OF SANITARY AND PHYTOSANITARY MEASURES (SPS AGREEMENT)

This agreement addresses the variety of measures used by governments to ensure that human and animal food is safe from contaminants, toxins, diseases-causing organisms and additives. Measures to protect human health from pests or diseases carried by plants and animals as well as to prevent establishment or spread of pests (WTO, 1996). The SPS Agreement explicitly recognises the right of governments to take measures to protect human, animal and plant health, but where trade restrictions are enforced these measures are taken only to the extent necessary for health protection on the basis of scientific principles and evidence. If there is not sufficient scientific evidence, governments may temporarily impose precautionary restrictions while obtaining further information. Governments are to determine the level of health protection they consider to be appropriate on the basis of an evaluation of the risks involved. SPS measures are to be applied in a non-discriminatory manner. Furthermore, if there are a number of measures available, governments should use those that are the least trade restrictive, if at all technically and economically feasible.

The SPS Agreement permits members to impose different sanitary and phytosanitary measures on food, animal or plant product sources from different countries, provided that they "do not arbitrarily or unjustifiable discriminate between countries where identical or similar conditions prevail". The rational for this is due to differences in climate, pests or diseases and food safety conditions. The provisions of the Agreement explicitly permit governments to choose not to use international standards. National standards that are higher than international standards are allowed, but should they result in a greater restriction of trade, the government may be asked to show scientific justification for this measure or they should demonstrate that the international standard would not result in the level of health protection it considers appropriate.

NATIONAL PLANT PROTECTION ORGANISATION FOR SOUTH AFRICA

South Africa participates in a number of preferential trade relationships, both regional and bilateral. South Africa was a founding member of the General Agreement on Tariffs and Trade in 1947 and is also an active member of the relevant global policy-making organisations. The central body is the WTO and its Agreement on Sanitary and Phytosanitary measures. South Africa is also a signatory member of the IPPC and the FAO. As a member of the IPPC, South Africa undertakes to implement common and effective measures on national and international level to prevent the importation and distribution of pests of plants and plant products, to promote the methods for the control of pests and to establish legal, technical and administrative measures necessary to achieve the goals of the Convention.

The Directorate Plant Health of the Department of Agriculture is the official NPPO of South Africa in terms of South Africa's membership of the IPPC. This department, by administering the Agricultural Pests Act, 1983 (Act No. 36 of 1983) with applicable regulations, has the responsibility to prevent the introduction and spread of harmful invasive plant pests and diseases. The importance of this regulatory service is to facilitate trade, increase exports, protect the export markets, and control imports and to prevent the degradation of natural resources. This department must make provision for quarantine measures and facilities, inspection guidelines as well as for inspection services at all ports of entry to monitor the movement of people and cargo into international airports, seaports and border posts for the introduction of exotic or foreign plant pests, diseases, insects, nematodes and weeds. It is a major challenge to succeed in this mission of identifying harmful pest, to assess and manage risk, while at the same time making provision for regional and international trade.

The Directorate Plant Health also communicates on behalf of the department and local industries with international bodies such as the IPPC and NPPOs of other countries to which South Africa exports regarding import conditions and export programmes. As a member of the WTO-SPS and IPPC, South Africa has certain responsibilities. Phytosanitary measures (import conditions) must be based on scientific facts (technically justified) and also reliable information must be provided to trading partners regarding the presence of pathogens and pests within South Africa.

AIMS OF STUDY

The main objective of this study is to compile a comprehensive list of fungal pathogens that occur worldwide and in South Africa on *Vitis* and *Malus* species and to scientifically justify the A1-regulated status of the pathogens *Neonectria galligena* and *Monilina fructicola* supposedly occurring in South Africa. Knowing which fungi occur in South Africa will provide information upon which quarantine decisions can be made. This ensures scientific justified measures (import regulations) to protect our valuable agricultural industries and our access to export markets.

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2. COMPILATION OF COMPREHENSIVE LISTS OF FUNGAL PATHOGENS ASSOCIATED WITH *MALUS* AND *VITIS* SPECIES, WITH REFERENCE TO THEIR OCCURRENCE IN SOUTH AFRICA

ABSTRACT

Global trade, travel and tourism (with the risk of introducing unwanted pests as a concomitant) are placing increasing pressure on the quarantine system of South Africa. As a signatory member of the Agreement on the Application of Sanitary and Phytosanitary Measures of the World Trade Organisation, South Africa has the right to implement appropriate measures to protect its plant health and environment. To set the appropriate levels for protection, South Africa must either apply to international standards or undertake a scientifically-based risk analysis process to justify quarantine measures. These measures must also be the minimum necessary to protect plant health. A key element in negotiations for market access is the provision of lists of regulated pests, as well as a list of all pests associated with a specific crop within the exporting country to trading partners. Voucher disease specimens or cultures lodged in recognised collections are a crucial basis for such published lists. In this study, comprehensive lists of fungal pathogens of *Malus* spp. and *Vitis* spp. occurring world-wide with special reference to South Africa were compiled. Seventy-one fungal pathogens of potential quarantine importance to South Africa were also identified for further evaluation by the National Plant Protection Organisation of South Africa according to international standards. This will serve as a first step to improve the plant health status of these crops in South Africa, and to enhance new market access negotiations. As part of the ongoing process, all researchers are summoned to validate new pest records and to submit voucher specimens to the National Collection of Fungi in Pretoria.

INTRODUCTION

Plant health has always influenced international trade (Devorshak, 2002; McRae *et al.*, 2002). Prior to the foundation of the World Trade Organisation (WTO) in 1995, most countries have already developed quarantine (phytosanitary) measures or regulations for the importation of plants and plant products to prevent the introduction and spread of harmful, exotic plant pests and diseases. Initially these regulations comprised of lists of prohibited pests and restrictions on certain imports. As no official criteria existed, the decision to compile these lists was based on advice of national experts of a country. These quarantine measures were not scientifically based. The justification for these measures, which imposed non-tariff barriers to trade, were often questioned by exporting countries, but no legal basis to redress these situations existed (Burgess, 2003).

The backbone for non-discriminatory, fair, predictable and transparent international trade is the set of rules that national governments have agreed to follow (McRae *et al.* 2002). From 1948 until 1995, these rules were embodied in the General Agreement on Tariffs and Trade (GATT). The WTO was founded in 1995, which included the old GATT-agreement (WTO, 1994, 1999). With the establishment of the WTO, the "WTO - Agreement on the Application of Sanitary and Phytosanitary measures (WTO-SPS)" also came into force. This agreement lays out the provisions, rights and obligations of countries in setting measures to protect human, animal and plant life and health. It also guides quarantine policy and decision-making, with the objective to prevent the use of quarantine measures by governments as disguised or unjustified trade barriers to protect their agricultural industries from import competition (WTO, 1996).

The WTO-SPS explicitly states that member countries retain their right to implement measures to protect human, animal and plant health, as well as their environments from risks associated with the introduction and spread of harmful, exotic pests and diseases. It further states that these measures should be based on sound scientific principles, which is not maintained without sufficient scientific evidence and must not be greater than necessary to reduce the risk to an appropriate level (EPPO, 1998). The WTO-SPS also requires governments to base their measures on international standards, and where these standards do not exit, they must be able to demonstrate that their measures are based on an assessment of risks and on appropriate imposition of protection measures. In order to make the decisions of which pests should be covered by phytosanitary regulations and which protection measures should be applied, a scientifically-based analysis of risk should be made.

The WTO-SPS recognises the International Plant Protection Convention (IPPC) as the relevant international organisation responsible for drafting, adopting and maintaining of international standards for phytosanitary measures (ISPMs). The two ISPMs that were adopted and are of particular relevance to provide scientifically justified phytosanitary measures and regulations are ISPM No. 2 – "Guidelines for Pest Risks Analysis" (FAO, 2004) and ISPM No. 11 – "Pest risks analysis for quarantine pests" (FAO, 1996), including analysis of environmental risks and living organisms.

According to the "Glossary of phytosanitary terms" (FAO, 2002), pest risk analysis (PRA) is the process of evaluating biological or other scientific and economic evidence to determine whether a pest should be regulated and the strength of any phytosanitary measure to be taken against it. A PRA comprises of three stages, namely i) initiation of the PRA, ii) risks assessment and iii) risk management. This process of evaluation guides the assessor through essential questions that should be answered in order to identify pests of quarantine importance. A pest of quarantine importance is defined as a pest of potential economic importance to the area endangered thereby, and not yet present there, or present, but not widely distributed and being officially controlled (FAO, 2002). It also needs to establish phytosanitary measures or regulations for these pests that are least trade restrictive, but that meet the level of protection appropriate for the specific country. However, to answer these questions it is of paramount importance to have access to information about the distribution, disease cycle, epidemiology, biology, host-pest relationship, host range and economic impact of the pest.

The starting point for the government of the importing country is to identify quarantine pests that may be associated with a specific plant commodity. To do this, the government must have access to accurate information about the status of plant pests and diseases associated with the commodity in its own country, as well as in the potential exporting country. One of the cornerstones of an effective and successful plant protection programme is detailed knowledge about the distribution of pests and pathogens within a country. As members of the WTO-SPS, countries are obligated to provide a list of pests of quarantine importance to trading partners, as well as a list of pests and diseases associated with a specific commodity, present in those countries. A crucial basis for these lists is voucher disease specimens and cultures lodged in recognised collections. When a country has accurate and freely available records of pests and diseases present in that country, especially pests and diseases that are of quarantine importance to that country, market access negotiations can progress smoothly to the benefit of all involved. However, long delays can occur when this information is not readily available. Relevant information with regard to pests and diseases is not always available or reliable. There is an urgent need to focus research towards obtaining these important data to conduct PRAs to conform to the international standards and guidelines as stipulated by the WTO-SPS.

As a signatory member of both the WTO-SPS and the IPPC, the main objective of South Africa's plant protection programme is to prevent the introduction, establishment and spread of invasive or foreign plant pests (Anonymous, 2005a). Protecting plant health in South Africa is becoming an increasingly important and difficult task. Several factors are contributing to this phenomenon, such as the ease of ever increasing global trade, tourism and travel, new export markets, expanding of existing export markets and the import of new plants and products from new sources. Success or failure of this programme will have an impact on all and sundry. The status of plant health in this country is maintained through the implementation of measures to facilitate trade (exporting and importing of plants and products) while protecting the life and health of humans, animals and plants. South Africa as a signatory of the WTO-SPS, must either apply measures based on international standards, or when these standards do not provide for the appropriate level of protection, a scientific-based risk analysis must be made to justify decisions.

South Africa is an export-driven country and exporters and industries of the different commodities are constantly seeking access to new markets and expanding of existing markets. The South African deciduous fruit industry is one of our major agricultural industries. For this industry, renowned for its high quality of fruit, an essential part of international competitiveness is the importation of new varieties. Currently, 21 326 hectares are under apple production and 12 319 hectares are under grape production in South Africa, and the total production for the 2003/2004 harvest was 701 000 and 1 600 000 tonnes, respectively (DFPT, 2004). From a quarantine perspective, apples and grapes are rated as "high risk crops". Apples and grapes are a major commercial crops and a number of devastating exotic pests associated with apples and grapes are currently absent from South Africa.

A comprehensive list of fungal pathogens associated with *Malus* and *Vitis* spp. worldwide, including South Africa, will enable the National Plant Protection Organisation in South Africa to conduct PRAs conforming to international guidelines and regulations. It will also provide the required information to trading partners. In doing so, phytosanitary measures that are based on scientific justification can be established and maintained. These measures will meet the level of appropriate protection deemed necessary to protect our deciduous fruit industry with the importation of vegetative propagation material as well as fresh fruit. When such a published list, based on specimens and cultures lodged in a recognised culture collection in South Africa is freely available, it will also enhance new market access negotiations, with obvious benefits to the people of South Africa.

The Plant Protection Research Institute in Pretoria, which forms part of the Agricultural Research Council of South Africa, holds the most comprehensive reference collections of plant pathogens in South Africa. The two collections are the Culture Collection (PPRI) and the National Herbarium of Fungi (PREM). PPRI keeps and supplies fungal cultures of agricultural and South African origin, while PREM serves as the national depository for plant pathological and fungal specimens. Specimens are available on conditional loan (Anonymous, 2005b).

The aim of this study was to compile comprehensive lists of fungal pathogens of *Malus* and *Vitis* spp. that occur worldwide, with special reference to their occurrence in South Africa, as well as the availability of reference cultures or specimens.

MATERIALS AND METHODS

Data survey and entry. The software programme, Microsoft Access, was used for the design of a database to manage the information. The data included in the compilation of this list was based on the information needed by the key stakeholders. For the purpose of this list, the key stakeholders were identified as the quarantine officers of the National Plant Protection Organisation (NPPO) and the Deciduous Fruit Industry of South Africa. These officers need specific information about fungal pathogens to answer essential questions when conducting a PRA.

The fields used in the database were: scientific names, synonyms/other stages, common name for disease caused by the organism, other host plants, saprophytism, plant parts affected (fruit, vegetative material, roots), vector transmission, presence in South Africa, reference culture lodged at PREM/PPRI, economic impact, current quarantine status in South Africa, eligible for further consideration by SA-NPPO and literature references. Presence of the records in South Africa was based on literature citation and not on specimens and cultures lodged at PPRI and/or PREM. The teleomorphic or sexual stage is also listed for all fungi concerned. The anamorphic or asexual stage is not indicated separately, but is listed as part of the 'synonyms/other stages' field. It was, however, not possible to list all the synonyms published for each record, and only the current and commonly used synonyms were listed.

Information was also provided about the current quarantine status (A1-pest) of fungal pathogens important to *Malus* spp. and *Vitis* spp. in South Africa. In cases where literature have revealed that the specific record is of moderate to high economic importance, and the specific fungus is not present in South Africa, the record is highlighted as eligible for further consideration by the NPPO of South Africa as a potential pest of quarantine importance. Appropriate references are also included.

The relevant data was drawn from a wide range of available data systems (electronic databases) and literature resources by means of a thorough search for all pathogens recorded on *Malus* spp. and *Vitis* spp. throughout the world, including South Africa. In order to provide reliable information to the key stakeholders, a process of elimination was followed. The elimination process was based on the following criteria, namely i) synonymy ii) teleomorphic / anamorphic relationships and iii) no association with a specific symptom or disease or *Malus* or *Vitis* spp. as a host.

RESULTS

Data survey and entry. The literature search resulted in comprehensive lists of fungal pathogens occurring world-wide and in South Africa on *Malus* spp. (Table 1) and *Vitis* spp. (Table 2). It was not possible to print all fields used in the database in this document. Fields containing no or very little information (such as culture/specimen lodged in collection and vector transmission) were not included. The field about the economic importance was also not included, because most of the records are of minor importance. The pathogens of moderate to major importance are identified as eligible for further consideration by the South African NPPO (Tables 1 and 2). Although every effort was made to ensure that all pathogens were included, this is not a final list, but it should be regarded as a working document that requires regular updating as more research is completed.

The research has resulted in an original list of 864 fungal pathogens on *Malus*, and 983 on *Vitis* spp. Changes were made to these records through the process of elimination and addition. Many records were removed as a result of synonymy, teleomorphic/anamorphic relationships, no association with a specific symptom or disease and no association with *Malus* or *Vitis* spp. (Tables 3 and 4). Records were also added to the list as a result of synonyms found in literature. For comprehensiveness, many records were listed with limited information available.

The study has furthermore revealed that only 24 specimens of fungi recorded in South Africa on *Malus* spp. and 12 specimens of fungi recorded in South Africa on *Vitis* spp. are lodged in the National Collection of Fungi (Tables 5 and 6).

DISCUSSION

The purpose of the compiled lists of fungal pathogens was to enable the SA-NPPO to fulfil their obligations as a WTO member in supplying new trading partners with lists of fungal pathogens present in South Africa on *Malus* and *Vitis* spp., and to conduct PRAs. In doing so, South Africa will be able to scientifically demonstrate that trade restrictions (import requirements) imposed are necessary to protect our valuable industries and environment against the introduction of new harmful species.

Internationally, the plant health status of a country is seen only as good as the plant health diagnostic capacity of that country (McRae *et al.*, 2002). As a member of the WTO, South Africa has the responsibility to verify both the level of risk and the magnitude of the threat before it can justify phytosanitary barriers to trade. According to the WTO-SPS, verification is interpreted that countries maintain a diagnostic capability and databases to record verified plant pests and diseases. It is known that not all published records are always accurate, and many records are solemnly based on visual symptoms without the necessary scientific evidence. To overcome this problem of records not based on scientific evidence, there is an increased awareness of the usefulness of plant disease collections as sources of verifiable information.

In compiling these lists, a weakness that was identified is the lack of voucher specimens of all disease records in South Africa's national collections (PPRI and PREM). Furthermore, many of the specimens lodged in the PREM have not been verified for accuracy, therefore the dissuasion not to base the presence of pathogens recorded in South Africa on specimens and cultures as lodged in the National Collection. Many disputes have arisen during the past years about the presence of pathogens in South Africa. These disputes were not settled due to the fact that only literature records of the pest exist with no official/voucher herbarium records.

These lists were a step taken to help to improve the plant health status of South Africa as such relevant published information was not previously readily available. It will definitely enhance new market access negotiations, with obvious benefits to the people of South Africa. Seventy-one fungal pathogens of potential quarantine importance to South Africa were also identified for evaluation or possible revision of import requirements and updating of the A1-pest list for South Africa by the NPPO according to international standards.

This information will hopefully help to settle some of the disputes over the presence or absence of pathogens on these crops in South Africa. In order to assist our NPPO to safeguard South Africa against harmful invasive species and to have access to accurate plant health status information, it is incumbent on researchers to validate new pest records and to submit voucher specimens to our National Collection.

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Table 1. List of fungal pathogens reported on *Malus* spp.

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Abortiporus biennis (Bull.: Fr) Singer	*Heteroporus biennis* (Bull.:Fr) Lázaro; *Polyporus biennis* (Bull.) Fr.		*Acer, Carya, Olea, Ulmus*	No	No	No	No	No	No	No	7, 26
Acremonium implicatum (Glim. & Abbott) Gams	*Acremonium terricola* (Mill., Giddens & Foster) Gams; *Fusidium terricola* Mill., Giddens & Foster; *Monilia implicata* Gilman & Abbott; *Sagrahamala implicata* (Gilman & Abbott) Subram.	Fruit rot		No	Yes	No	No	No	No	No	7, 26, 30
Alternaria alternata (Fries) Keissl.	*Alternaria fasiculata* (Cooke & Ellis) Jones & Grout; *Alternaria rugosa* McAlpine; *Alternaria tenuis* Nees; *Macrosporium fasciculatum* Cooke & Ellis; *Macrosporium maydis* Cooke & Ellis; *Torula alternata* Fr.	Alternaria leaf spot, Alternaria rot	Wide host range	No	Yes	Yes	No	Yes	No	No	7, 12, 26, 27, 70
Alternaria infectoria Simmons		Core rot		Yes	Yes	No	No	Yes	No	No	70
Alternaria mali Roberts		Alternaria blotch of apple, cork spot, leaf spot		No	No	Yes	No	No	No	Yes	1, 7, 8, 17, 26
Alternaria malorum (Rühle) Braun, Crous & Dugan	*Cladosporium malorum* Rühle	Fruit rot	*Pyrus*	No	Yes	No	No	No	No	No	7, 26
Alternaria pomicola Horne				No	No	Yes	No	No	No	No	7, 26
Alternaria tenuissima (Kunze) Wiltshire	*Clasterosporium tenuissimum* (Nees & T. Nees) Sacc.; *Macrosporium tenuissimum* (Kunze) Fr.	Core rot		No	Yes	No	No	Yes	No	No	70

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Antrodia malicola (Berk. & Curtis) Donk	*Coriolellus malicola* (Berk. & Curtis) Murrill; *Daedalea malicola* (Berk. & Curtis); *Trametes malicola* (Berk. & Curtis)		Wide host range	No	No	Yes	No	No	No	No	7, 26
Aplosporella mali (Westend.) Petr. & Syd.	*Haplosporella mali* (West.) Petrak			No	No	Yes	No	No	No	No	7, 26
Aposphaeria fuscomaculans Sacc.	*Plenodomus fuscomaculans* (Sacc.) Coons	Canker		No	No	Yes	No	No	No	No	7, 26
Armillaria limonea (Stev.) Boesew.	*Armillariella limonea* Stev.	Armillaria root rot	Wide host range	No	No	Yes	Yes	No	No	Yes	7, 39
Armillaria luteobubalina Watling & Kile		Armillaria root rot	Wide hosrt range	No	No	Yes	Yes	No	No	Yes	7, 8, 26
Armillaria mellea (Vahl:Fr) Kummer	*Agaricus melleus* Vahl:Fr.; *Armillariella mellea* Karst.; *Clitocybe mellea* (Vahl) Ricken; *Lepiota mellea* (Vahl) Lange; *Rhizomorpha subcorticalis* Pers.	Armillaria root rot	Wide host range	No	No	Yes	Yes	Yes	No	No	7, 8, 26
Armillaria novae-zelandiae (Stev.) Boesew.	*Armillaria novae-zelandiae* (Stev.) Herink; *Armillariella novae-zelandiae* Stev.	Armillaria root rot	Wide host range	No	No	Yes	Yes	No	No	Yes	7, 39
Armillaria tabescens (Scop.) Emel	*Agaricus tabescens* Scop; *Armillariella tabescens* (Scop.) Singer; *Clitocybe monadelpha* (Morg.) Sacc.; *Clitocybe tabescens* (Scop.) Bres.; *Clitocybe parasitica* Wilcox	Armillaria root rot	Wide host range	No	No	Yes	Yes	No	No	Yes	7, 8, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Ascochyta mali Ellis & Everh.				No	No	No	No	No	No	No	7, 26
Ascochyta malvicola Sacc.				No	No	No	No	No	No	No	7
Aspergillus clavatus Desm.			*Pseudotsuga, Zea*	No	Yes	No	No	No	No	No	7, 26
Aspergillus elegans Gasperini	*Aspergillus alutaceus var. elegans* (Gasperini) Kozak.; *Sterigmatocystis elegans* (Gasp.) Sacc.		*Cucumis, Zea*	No	Yes	No	No	No	No	No	7, 26
Aspergillus flavus Link	*Aspergillus fasciculatum* (Costantin & Lucet) Blochwitz; *Aspergillus humus* (Costantin & Lucet) Blochwitz; *Aspergillus luteus* (Costantin & Lucet) Blochwitz; *Aspergillus wehmeri* Costantin & Lucet	Rot	Wide host range	No	Yes	No	No	Yes	No	No	7, 8
Aspergillus fumigatus Fresen.			Wide host range	Yes	Yes	No	No	No	No	No	7, 26, 43
Aspergillus niger Tiegh.	*Aspergillus ficuum* Tiegh.; *Aspergillus phoenicis* Tiegh.; *Aspergillopsis nigra* (Tiegh.) Speg.; *Sterigmatocystis niger* Tiegh.	Rot	Wide host range	No	Yes	Yes	Yes	Yes	No	No	7, 8, 26, 44
Aspergillus sclerotiorium Huber				No	Yes	No	No	No	No	No	7, 26
Aspergillus wentii Wehmer		Fruit rot	*Carya, Helianthus, Prunus, Zea*	No	Yes	No	No	No	No	No	7, 26
Asteromella mali (Briard) Boerema	*Phyllosticta mali* Briard			No	No	Yes	No	No	No	No	7, 26
Athelia bombacina (Link) Pers.	*Sporotrichum bombacinum* Link		*Populus, Quercus*	No	No	Yes	No	No	No	No	7, 26
Athelia rolfsii (Curzi) Tu & Kimbrough	*Corticium rolfsii* Curzi; *Pellicularia rolfsii* West; *Sclerotium rolfsii* Sacc.	Southern blight	Wide host range	No	No	No	Yes	Yes	No	No	7, 8, 12, 26, 27

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Aureobasidium pullulans (de Bary) Arnaud var. *pullulans*	*Aureobasidium pullulans* (de Bary) Arnaud; *Candida malicola* Clark & Wallace; *Cladosporium pullulans* (de Bary) Sacc. & Trotter; *Dematium pullulans* de Bary & Löwenthal; *Pullularia pullulans* (de Bary & Löwenthal) Berkhout			Yes	No	No	No	Yes	No	No	7, 26
Berkleasmium moriforme (Peck) Moore	*Sporidesmium moriforme* Peck		Acer	Yes	No	No	No	No	No	No	7, 26
Bionectria ochroleuca (Schwein.) Schroers & Samuels	*Gliocladium roseum* Bainer; *Nectria gliocladioides* Smalley & Hansen; *Polystigma vulgare* (Speg.) Gola; *Sphaeria ochroleuca* Schwein.		Wide host range	No	No	Yes	No	No	No	No	7, 26
Biscogniauxia marginata (Fr.) Pouzar	*Biscogniauxia discincola* (Schwein.) Lar.N.; *Nummularia discincola* (Schwein.) Cooke; *Nummularia peziziformis* Lloyd; *Nummulariella marginata* (Fr.) Eckblad & Granmo; *Numulariola discreta* (Schwein.) House; *Sphaeria discreta* Schwein.	Nailhead canker, blister canker	Wide host range	No	No	Yes	No	No	No	Yes	1, 7, 26
Bjerkandera adusta (Willd.) Karst.	*Boletus adustus* Willd.; *Polyporus adustus* (Willd.) Fr.; *Polyporus crispus* (Pers.) Fr.; *Polystictus adustus* (Willd.) Fr.; *Tyromyces adustus* ((Willd.) Pouzar	Stem rot, white rot	Wide host range	No	No	Yes	No	Yes	No	No	7, 12, 26, 27
Bloxamia truncata Berk. & Broome				No	No	Yes	No	No	No	No	7
Boreostereum radiatum (Peck) Parmasto	*Stereum radiatum* Peck; *Thelephora corrugata* Lév.		*Picea, Pinus, Tsuga*	No	No	Yes	No	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Botryosphaeria berengeriana f.sp. pyricola (Nose) Koganezawa & Sakuma	*Guignardia piricola* (Nose) Yamamoto; *Macrophoma kuwatsukai* Hara; *Macrophoma pirorum* Cooke; *Physalospora piricola* Nose	Apple ring rot, apple canker	*Pyrus*	No	Yes	Yes	No	No	No	Yes	7, 8, 18
Botryosphaeria dothidea (Moug.) Ces & De Not.	*Caumadothis dothidea* (Moug.) Petr.; *Botryosphaeria berengeriana* De Not.; *Fusicoocum aesculi* Corda; *Physalospora suberumpens* Ellis & Eveh.; *Sphaeria dothidea* Moug. Ex Fr.	White rot, fruit rot, canker	Wide host range	No	Yes	Yes	No	Yes	No	No	7, 12; 26, 30
Botryosphaeria iberica Phillips, Luque & Alves	*Dothiorella iberica*	Canker	Wide host range	No	No	Yes	No	No	No	No	7, 26, 64
Botryosphaeria lutea Phillips	*Fusicoccum luteum* Pennycook & Samuels		Wide host range	No	No	Yes	No	No	No	No	7, 26, 63
Botryosphaeria obtusa (Schwein.) Shoemaker	*Botryodiplodia juglandicola* (Schwein.) Sacc.; *Physalospora cydoniae* Arnaud; *Physalospora malorum* Peck.; *Physalospora obtusa* (Schwein.) Cooke; *Sphaeropsis malorum* (Schwein.) Cook *Sphaeria obtusa* Schwein.; *Valsa juglandicola* (Schwein.) Cooke	Black rot, frog-eye leaf spot, trunk canker	Wild host range	No	Yes	Yes	No	Yes	No	No	7, 12, 26, 27, 66, 74
Botryosphaeria parva Pennycook & Samuels	*Fusicoccum parvum* Pennycook & Samuels	Canker, die back	Wide host range	No	Yes	Yes	No	Yes	No	Yes	7, 12, 73
Botryosphaeria quercuum (Schwein.) Sacc.	*Botryosphaeria ambiqua* (Schwein.) Sacc; *Botryosphaeria dasylirii* (Peck) Theiss. & Syd.; *Physalospora lcupressi* (Berk. & curtis) Sacc.; *Sphaeria quercuum* Schwein.	Black rot, frog-eye leaf spot, limb, twig canker	Wide host range	No	Yes	Yes	No	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Botryosphaeria rhodina (Berk. & Curtis) Arx	*Diplodia natalensis* Pole-Evans; *Lasiodiplodia theobromae* (Pat.) Griff. & Maubl.; *Physalospora rhodina* Berk. & Curtis	Shoot blight, stem end rot, canker, root rot, fruit rot	Wide host range	No	Yes	Yes	Yes	Yes	No	No	7, 26, 68
Botryosphaeria ribis Grossenbacher & Duggar	*Botryodiplodia ribis* (Fuckel) Petr.; *Botryodiplodia ribis* Gross. & Duggar f. chromogena Gross. & Duggar; *Botryosphaeria berengeriana De Not.*; *Botryosphaeria mali* Putterill; *Dothiorella ribis* (Fuckel) Sacc.,;	Die back and canker, apple fruit rot, white rot	Wide host range	No	Yes	Yes	No	Yes	No	No	7, 8, 12, 26, 67
Botryotinia fuckeliana (de Bary) Whetzel	*Botrytis cinerea* (Pers.); *Botrytis fuckeliana* Buchw.; *Haplaria grisea* Link; *Peziza fuckeliana* de Bary; *Sclerotinia fuckeliana* (de Bary) Fuckel	Grey mould/rot	Wide host range	No	Yes	Yes	No	Yes	No	No	7, 8, 12, 26, 27, 70, 74
Butlerelfia eustacei Weresub & Illman	*Corticium centrifugum* (Lev.) Bres.	Fish-eye rot		Yes	Yes	No	No	No	No	No	7, 26, 30
Calonectria gracilis Crous, Wingfield & Alfenas	*Cylindrocarpon gracile* Bugnicourt Boesew.	Rot	Wide host range	No	No	Yes	Yes	No	No	No	7, 11
Calonectria kyotensis Terash.	*Calonectria floridana* Sobers; *Calonectria morganii* Crous, Alfenas & Wingf.; *Cylindrocladium floridanum* Sobers & Seym.; *Cylindrocladium scorparium* Morgan	Root rot		No	No	No	Yes	No	No	No	7, 26
Camarosporium karstenii Sacc. & Syd.				No	No	No	No	No	No	No	7, 26
Camarosporium mali Ellis & Everh.				No	No	Yes	No	No	No	No	7, 26
Camarosporium multiforme Karst.				No	No	Yes	No	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Cenangium tuberculiforme Ellis & Everh.				No	No	No	No	No	No	No	7, 26
Cephalosporium carpogenum Rühle		Fruit rot	*Pyrus*	No	Yes	No	No	No	No	No	7, 26
Cephalosporium roseum Oudem				No	No	No	No	Yes	No	No	7, 26
Ceratocystis adiposa (Butler) Moreau	*Ceratocystis major* (Beyma) Moreau; *Ceratostomella adiposa* (Butler) Sartoris; *Ceratostomella major* Beyma; *Ophiostoma adiposa* (Butler) Nannf.; *Ophiostoma majus* (Beyma) Goid.; *Sphaeronaema adiposum* Butler	Fruit rot	*Saccharum*	No	Yes	No	No	No	No	No	7, 30
Cercospora pyri Farl.	*Cercosporella pyri* (Farl.); *Mycovellosiella pyri* (Farl.) Braun	Leaf spot	*Pyrus*	No	No	Yes	No	No	No	No	7, 26
Cercosporella pyrina Ellis & Everh.	*Cercospora pirina* Ellis & Everh.; *Mycovellosiella pyrina* (Ellis & Everh.) Braun	Leaf spot	*Aronia*	No	No	Yes	No	No	No	No	7, 26
Ceriporia spissa (Schwein.: Fr.) Rajchenb.	*Boletus juglandinus* Schwein.; *Physisporinus spissus* (Schwein.) Murrill; *Polyporus crocipora* (Berk. & Curtis) *Polyporus spissus* Schwein.; *Poria crocipora* (Berk. & Curtis) Sacc.; *Poria spissa* (Schwein.) Cooke	Wood rot	Wide host range	No	No	Yes	No	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Ceriporiopsis pannocincta (Romell) Gilb. & Ryvarden	*Gelatoporia pannocincta* (Romell) Niemelä; *Gloeoporus pannocinctus* (Romell) Erikss.; *Poria pannocincta* (Romell) Lowe; *Polyporus pannocinctus* Romell; *Tyromyces pannocinctus* (Romell) Kotl. & Pouzar	Wood rot	*Betula, Pinus, Populus*	No	No	Yes	No	No	No	No	7, 26
Cerrena unicolor (Bull.) Murrill	*Agaricus cinereus* (Pers.) Krause; *Coriolus unicolor* (Bull.) Pat.; *Daedalea unicolor* (Bull.) Fr.; *Polyporus latissimus* Fr.; *Trametes unicolor* (Bull.) Pilát	Wood rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Chaetomium funicola Cooke	*Chaetomium dolichotrichum* Ames	Fruit rot	Wide host range	No	Yes	No	No	No	No	No	7, 26
Chaetomium globosum Kunze	*Chaetomium chlorinum* (Sacc.) Grove; *Chaetomium coarctatum* Sergeeva; *Chaetomium cochliodes* Palliser; *Chaetomium subglobosum* Sergeeva			No	Yes	No	No	No	No	No	7, 26
Chaetomium trilaterale Chivers	*Chaetomium rubrogenum* Van Warmelo	Fruit rot	*Arachis, Glycine*	No	Yes	No	No	No	No	No	7, 26
Cheiromycella chomatospora (Corda) Boerema, Dorenb. & Kesteren	*Coniothecium chomatosporum* Corda	Paper bark, fruit cracking	*Pyrus*	No	Yes	Yes	No	Yes	No	No	7, 12, 26, 27
Chondrostereum purpureum (Pers.) Pouzar	*Stereum purpureum* Pers.; *Stereum rugosiusculum* Berk. & Curtis	Silver leaf, heart rot	Wide host range	No	No	Yes	No	Yes	No	No	7, 8, 12, 26, 74

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Cladosporium cladosporioides (Fresen.) de Vries	*Hormodendrum cladosporioides* (Fresen.) Sacc.; *Monilia humicola* Oudem.; *Penicillium cladosporioides* Fresen.	Fruit rot	Wide host range	No	Yes	No	No	Yes	No	No	7, 26
Cladosporium elatum (Harz) Nannf.	*Cadophora elatum* (Harz) Nannf.; *Cladosporium elatium* (Harz) Nannf.; *Hormodendrum elatum* Harz	Fruit rot	*Medicago, Pisum, Trifolium, Vicia*	No	Yes	No	No	No	No	No	7, 26
Cladosporium extorre Sacc.			*Pyrus*	No	No	Yes	No	No	No	No	7, 26
Cladosporium sphaerospermum Penz				Yes	No	No	No	No	No	No	7, 26
Clathrospora diplospora (Ellis & Everh.) Wehm.	*Pleospora diplospora* Ellis & Everh.			No	No	Yes	No	No	No	No	7, 26
Climacodon septentrionalis (Fr.) Karst.	*Creolophus septentrionalis* (Fr.) Banker; *Hydnum septentrionale* Fr.; *Steccherinum septentrionale* (Fr.) Banker	Sapwood rot	*Acer, Carya, Populus, Quercus*	No	No	Yes	No	No	No	No	7, 26
Coleophoma empetri Rostr.) Petr.	*Rhabdostromina empetri* (Rostr.) Died.; *Septoria empetri* Rostr.; *Sporonema oxycocci* Shear	Fruit rot	Wide host range	No	Yes	No	No	No	No	No	7, 26
Colletotrichum acutatum Simmonds	*Glomerella acutata* Guerber & Correll	Fruit rot	Wide host range	No	Yes	No	No	Yes	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Colletotrichum dematium (Pers.) Grove	*Colletotrichum bakeri* (Syd. & Syd.) Mundk.; *Colletotrichum fructus* (Stevens & Hall) Sacc.; *Colletotrichum pucciniophilum* Togashi; *Ellisiellina volutella* (Sacc.) Bat.; *Vermicularia echinata* Kirschst.; *Vermicularia volutella* (Sacc. & Malbr.) Grove	Spongy dry rot	Wide host range	No	Yes	Yes	No	No	No	No	7, 26, 30
Colletotrichum musae (Berk. & Curtis) Arx.	*Gloeosporium musarium* Cooke & Massee; Myxosporium musae Berk. & Curtis	Anthracnose, fruit rot	*Musa*	No	Yes	Yes	No	No	No	No	7, 26, 77
Collybia drucei (Stev.) Horak	*Marasmius drucei* Stev.			No	No	No	No	No	No	No	7, 26
Coniophora puteana (Schumach.) Karst.	*Coniophora brunnea* (Schröt.) Falck; *Coniophora laxa* (Fr.) Quel.; *Corticium luteocinctum* (Berk.) Cooke; *Thelephora luteocincta* Berk.		Wide host range	No	No	Yes	No	No	No	No	7, 26
Coniothyrium convolutum Horne				No	No	Yes	No	No	No	No	7, 26
Coniothyrium cydoniae Brunaud				No	No	Yes	No	No	No	No	7, 26
Coniothyrium olivaceum Bonord.	*Microsphaeropsis olivacea* (Bonord.) Höhn.; *Microsphaeropsis olivaceus* (Bonord.) Höhn.			No	No	No	No	No	No	No	7
Coprinus psychromorbidus Redhead & Traquair	*Coprinopsis psychromorbida* (Redhead & Traquair) Redhead, Vilgalys & Moncalvo	Coprinus rot		No	Yes	No	No	No	No	No	7, 26, 30

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Coriolopsis gallica (Fr.) Ryvarden	*Cerrena gallica* (Fr.) Zmitr.; *Funalia gallica* (Bull.:Fr.) Bondartsev &Singer; *Hexagonia gallica* (Fr.) Teixeira; *Trametella extenuata* (Durieu & Mont.) Domanski; *Trametes hispida* Bagl.	White rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Coriolopsis polyzona (Pers.) Ryvarden	*Fomes wombaliensis* Beeli; *Microporus polyzonus* (Pers.) Kuntze; *Polystictus polyzonus* (Pers.) Cooke; *Trametes devexa* Berk.; *Trametes tomentosa* Van der Byl			No	No	Yes	No	Yes	No	No	7
Coriolus zonatus (Nees) Quél.	*Polyporus zonatus* Nees; *Trametes ochracea* (Pers.) Gilb. & Ryvarden			No	No	No	No	Yes	No	No	7
Corticium laetum (Karst.) Bres.	*Corticium anthochroum* (Pers.) Fr.; *Erythricium laetum* (Karst.) Erikss. & Hjortstam; *Hyphoderma laetum* Karst.; *Sporotrichum anthochroum* (Pers.) Pers.		*Alnus, Betula, Populus*	No	No	Yes	No	Yes	No	No	7, 26
Corticium litschaueri Burt	*Basidioradulum alienum* Parmasto; *Corticium niveum* Bres.; *Hyphoderma alienum* (Parmasto) Jülich; *Hyphoderma litschaueri* (Burt) Erikss. & Strid; *Hyphodontia nivea* (Bres.) Erikss.		*Alnus*	No	No	Yes	No	No	No	No	7, 26

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Corticium stevensii Burt.	*Botryobasidium koleroga* (Cooke) Venkatar.; *Ceratobasidium noxium* (Donk) Roberts; *Ceratobasidium stevensii* (Burt) Venkatar.; *Corticium koleroga* (Cooke) Höhn; *Koleroga noxia* Donk; *Pellicularia koleroga* Cooke	Thread blight	Wide host range	No	No	Yes	No	No	No	Yes	1, 7, 26, 30
Coryneopsis foliicola (Fuckel) Grove	*Coryneum foliicola* Fuckel			No	No	No	No	No	No	No	7
Coryneum longistipitatum Berl. & Bres.	Sporocadus longestipitatus (Berl. & Bres.) Orsenigo, Rodondi & Sutton		*Amelanchier, Pyrus*	No	No	Yes	No	No	No	No	7, 26
Cristinia gallica (Pilát) Jülich	*Cristinia mucida* sensu Eriksson; *Hydnum mucidum* Pers.; *Radulum mucidum* sensu Bourdot; *Thelephora mucida* sensu auct.		*Persea*	No	No	Yes	No	No	No	No	7, 26
Cristulariella moricola (Hino) Redhead	*Botrytis moricola* Hino; *Cristulariella pyramidalis* Waterman & Marshall; *Grovesinia pyramidalis* Cline, Crane & Cline; *Sclerotium cinnamomi* Sawada	Zonate leaf spot	Wide host range	No	No	Yes	No	No	Yes	No	7, 26
Cryptocoryneum condensatum (Wallr.) Mason & Hughes	*Hormiscium uniforme* (Peck) Sacc.; *Torula uniformis* Peck		*Acer*	Yes	No	No	No	No	No	No	7, 26
Cryptosporiopsis corticola (Edgerton) Nannf.	*Myxosporium corticola* Edgerton	Fruit rot and bark canker	*Pyrus*	No	Yes	Yes	No	Yes	No	No	7, 12, 26, 27

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Cucurbitaria obducens (Schumach.) Petr.	*Psilosphaeria plateata* (Schumach.) Stev.; *Sphaeria obducens* Fr.; *Strickeria obducens* (Fr.) Winter; *Teichospora obducens* (Schumach.) Fuckel		*Crataegus, Ribes*	No	No	Yes	No	No	No	No	7, 26
Cylindrocarpon angustum Wollenweb.				No	No	Yes	No	No	No	No	7, 26
Cylindrocarpon didymum (Harting) Wollenw.	*Fusarium didymum* (Harting) Lind.; *Fusisporium didymum* Harting; *Ramularia didyma* (Harting) Wollenw.	Root rot	Wide host range	No	No	No	Yes	No	No	No	5, 7, 26
Cylindrocarpon magnusianum Wollenweb.	*Cylindrocarpon ehrenbergii* Wollenweb; *Nectria ramulariae* (Wollenweb) Muller *Ramularia magnusiana* (Sacc.) Lindau; *Septocylindrium magnusianum* Sacc.; *Spermosporina magnusiana* (Sacc.) Braun	Fruit rot	-	No	Yes	No	No	No	No	No	7, 26, 30
Cyphella marginata McAlpine	*Maireina marginata* (McAlpine) Cooke		*Cytisus, Prunus*	No	No	Yes	No	No	No	No	7, 26
Cystostereum murrayi (Berk. & Curtis) Pouzar	*Corticium effusum* Overh.; *Corticium tuberculosum* (Fr.) Rick; *Stereum murrayi* (Berk. & Curtis) Burt;	Heart rot, stem canker	Wide host range	No	No	Yes	No	No	No	No	7, 26
Cytospora carphosperma Fr.	*Cytospora leucosperma f. carphosperma* (Fr.) Gvrit.			No	No	Yes	No	No	No	No	26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Cytospora chrysosperma (Pers.) Fr.,	*Cytospora pulcherrima* Dearn. & Hansbrough *Naemaspora chrysosperma* Pers.; *Valsa sordida* Nitschke		*Acer, Betula, Populus, Prunus, Quercus, Salix, Sorbus*	No	No	Yes	No	No	No	No	7, 26
Cytospora leucosperma (Pers.) Fr.	*Cytospora ambiens* Sacc.; *Cytospora juglandicola* Ellis. & Everh.; *Naemaspora leucosperma* Pers.; *Valsa ambiens* (pers.:Fr.) Fr.; *Valsa leucostomoides* Peck	Canker, die back	Wide host range	No	No	Yes	No	No	No	No	7, 26
Cytospora leucosticta Ellis & Barthol.		Canker, die back		No	No	Yes	No	No	No	No	7, 26
Cytospora micropsora (Corda) Rabenh.	*Naemaspora microspora* Corda	Canker, die back	*Crataegus, Sorbus*	No	No	Yes	No	No	No	No	7, 26
Dacrymyces minor Peck			Wide host range	No	No	Yes	No	No	No	No	7, 26
Dacryopinax spathularia (Schwein.) Martin	*Guepinia spathularia* (Schwein.) Fr.; *Merulius spathularius* Schwein.		Wide host range	No	No	Yes	No	No	No	No	7, 26
Daedaleopsis confragosa (Bolton) Schröt.	*Amauroderma confragosum* (Van der Byl) Reid; *Boletus confragosus* Bolton; *Daedalea confragosa* (Bolten: Fr.) Fr.; *Ischnoderma confragosum* (Bolton) Zmitr.; *Trametes confragosa* (Bolton) Jørst.		Wide host range	No	No	Yes	No	No	No	No	7, 26
Daldinia concentrica (Bolton) Ces. & De Not.	*Hypoxylon concentricum* (Bolton) Grev.; *Peripherostoma concentricum* (Bolton) Gray,; *Sphaeria concentrica* Bolton		Wide host range	No	No	Yes	No	No	No	No	7, 26

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Daldinia occidentalis Child	*Nodulisporum* sp		Wide host range	No	No	Yes	No	No	No	No	7, 26
Daldinia vernicosa (Schwein.) Ces. & de Not.	*Hypoxylon vernicosum* (Schwein.) Berk. & Curtis; *Sphaeria vernicosa* Schwein.		Wide host range	No	No	Yes	No	No	No	No	7, 26
Dendrocorticium roseocarneum (Schwein.) Larsen & Gilbertson	*Corticium lilacino-fuscum* Berk. & Curtis; *Corticium roseocarneum* (Schwein.) Hjortstam; *Laeticorticium roseocarneum* (Schwein.) Boiden *Stereum lilacino-fuscum* (Berk. & Curtis) Lloyd;			No	No	Yes	No	No	No	No	7, 26
Dendrophora albobadia (Schwein.) Chamuris;	*Lopharia heterospora* (Burt) D.A. Reid; *Peniophora albobadia* (Schwein.) Boidin *Peniophora heterospora* (Burt) Boidin & Lanq. *Stereum albobadium* (Schwein.) Fr.; *Stereum heterosporum* Burt; *Thelephora albobadia* Schwein.	White rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Dendrophora versiformis (Berk. & Curtis) Chamuris;	*Lloydella versiformis* (Berk. & Curtis) Ito; *Peniophora versiformis* (Berk. & Curtis); Bourdot & Galzin *Stereum versiforme* Berk. & Curtis		Wide host range	No	No	Yes	No	No	No	No	7, 26
Diapleella coniothyrium (Fuckel) Barr	*Coniothyrium fuckelii* Sacc.; *Kalmusia coniothyrium* (Fuckel) Huhndorf; *Leptosphaeria coniothyrium* (Fuckel) Sacc. *Melanomma coniothyrium* (Fuckel) Holm; *Sphaeria coniothyrium* Fuckel	Leptosphaeria canker, fruit rot, bark canker	*Rosa*	No	Yes	Yes	No	Yes	No	No	7, 12, 26, 27

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Diaporthe actinidiae Sommer & Beraha		Stem end decay of fruit	*Actinidia*	No	Yes	No	No	No	No	No	7, 26
Diaporthe ambigua Nitschke	*Diaporthe eres* Nitschke; *Diaporthe mali* Miura; *Diaporthe perniciosa* Marchal; *Phomopsis ambigua* (Sacc.); *Phomopsis mail* Roberts; *Phomopsis perniciosa* Grove	Canker, Phomopsis canker, rough bark, fruit decay, leaf spot	*Pyrus, Prunus*	No	Yes	Yes	No	Yes	No	No	7, 12, 26, 75
Diaporthe tanakae Kobay. & Sakuma	*Phomopsis tanakae* Kobay. & Sakuma	Diaporthe canker, apple blight	*Pyrus*	No	No	Yes	No	No	No	Yes	1, 7, 26
Didymella mali Ellis & Everh				No	No	Yes	No	No	No	No	7, 26
Didymosphaeria bisphaerica (Cooke & Ellis)	*Amphisphaeria bisphaerica* (Cooke & Ellis) Sacc.; *Sphaeria bisphaerica* Cooke & Ellis			No	No	No	No	No	No	No	7, 26
Diplocarpon maculatum (Atk.) Jorst.	*Diplocarpon mespili* (Sorauer) Sutton; *Diplocarpon soraueri* (Kleb.) Nannf.; *Entomopeziza mespili* Höhn.; *Entomopeziza soraueri* Kleb.; *Entomosporium mespili* Sacc.; *Fabraea maculata* (Lév.) Atk.	Entomosporium leaf blight, Fabraea scald	Wide host range	No	No	Yes	No	Yes	No	No	7, 12, 26, 72
Diplodia malorum Fuckel	*Diplodia maura* Cooke & Ellis; *Diplodia pseudodiplodia* Fuckel		*Pyrus*	No	No	Yes	No	No	No	No	7, 26
Diplodia sarmentorum (Fr.) Fr.	*Cucurbitaria spiraearum* Fuckel; *Diplodia alni-rubrae* Peck; *Diplodia crataegi* Fuckel; *Otthia spiraeae* (Fuckel) Fuckel *Sphaeria sarmentorum* Fr.		Wide host range	No	No	Yes	No	No	No	No	7, 26

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Discostroma corticola (Fuckel) Brockmann	*Clethridium corticola* (Fuckel) Shoemaker & Müll.; *Seimatosporium lichenicola* (Corda) Shoemaker & Müll.; *Sphaeria corticola* Fuckel	Fruit rot, twig canker	Wide host range	No	Yes	Yes	No	No	No	No	7, 26, 30
Dothiorella gregaria Sacc.				No	No	Yes	No	No	No	No	7, 26
Dothiorella mali (Karst.) Ellis & Everh.	*Dothiora mali* Karst.; *Dothiorella pyrenophora var. mali* (Karst.) Sacc.			No	No	Yes	No	No	No	No	7, 26
Elsinoe piri (Woron.) Jenkins	*Plectodiscella piri* Woron.; *Sphaceloma pirinum* (Peglion) Jenkins	Anthracnose	*Cydonia, Pyrus*	No	Yes	Yes	No	No	No	No	7, 26
Endomyces mali Lewis	*Endomycopsis mali* (Lewis) Dekker	Post harvest decay		No	Yes	No	No	No	No	No	7, 26, 30
Epicoccum nigrum Link	*Epicoccum granulatum* Penz.; *Epicoccum purpurascens* Ehrenb.; *Epicoccum vulgare* Corda; *Phoma epicoccina* Punith.,Tulloch & Leach; *Toruloidea tobaica* Svilv.	Fruit rot	Wide host range	No	Yes	No	No	No	No	No	7, 26, 30
Erysiphe graminis f. sp. Avenae		Powdery mildew	Wide host range	No	No	Yes	No	No	No	No	7, 26
Erysiphe heraclei DC.	*Erysiphe communis var. umbelliferarum* (de Bary) Jacz.; *Erysiphe umbelliferarum* (Lév.) de Bary; *Ischnochaeta heraclei* (DC.) Sawada	Powdery mildew	*Daucus*	No	No	Yes	No	No	No	No	7, 26
Erythricium salmonicolor (Berk. & Broome) Burds.	*Botryobasidium salmonicolor* (Berk. & Broome); *Corticium salmonicolor* Berk. & Broome; *Necator decretus* Massee; *Pellicularia salmonicolor* (Berk. & Broome) Dastur	Branch and limb blight	Wide host range	No	No	Yes	No	Yes	No	No	7, 8, 12, 26, 27

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Eutypa lata (Pers.) Tul. & Tul.	*Cytosporina lata* Hohn,; *Diatrype lata* (Pers.) Fr.; *Eutypa velutina* (Wallr.) Sacc. *Libertella blepharis* Sm. *Sphaeria lata* Pers.; *Valsa lata* (Pers.) Nitschke	Canker and die back	Wide host range	No	No	Yes	No	Yes	No	No	7, 8, 26, 74
Eutypa leprosa (Pers.) Sacc.	*Eutypa ludibunda* Sacc.; *Eutypella leprosa* (Pers.) Berl.; *Sphaeria leprosa* Pers. ex Fr.; *Valsa leprosa* (Pers.) Nitschke		Wide host range	No	No	Yes	No	No	No	No	7, 26
Eutypa prunastri (Pers.) Tiffany & Gilman;	*Dermatea prunastri* (Pers.) Fr.; *Eutypella prunastri* (Pers.) Sacc.; *Sphaeria prunastri* Pers.		*Prunus*	No	No	Yes	No	No	No	No	7, 26
Eutypa scoparia (Schwein.) Tiffany & Gilman	*Diatrype hystrix* Fr.; *Eutypella scoparia* (Schwein.) Ellis & Everh.; *Valsa ceratophora sensu* Cooke; *Valsa heteracantha* Sacc.; *Valsa scoparia* (Schwein.) Curtis		Wide host range	No	No	Yes	No	No	No	No	7, 26
Eutypa stellulata (Fr.) Sacc.	*Cytosporina stellulata* Sacc.; *Eutypella radula* (Pers.:Fr.) Ellis & Everh.; *Eutypella stellulata* (Fr.:Fr.) Sacc.; *Valsa stellulata* (Fr.) Fr.,		Wide host range	No	No	Yes	No	No	No	No	7, 26
Exidia thuretiana (Lév.) Fr.	*Exidia albida sensu auct., p.p.; Tremella albida sensu auct., p.p.; Tremella cerebrina sensu auct., p.p.; Tremella hyalina sensu auct.; Tremella thuretiana* Lév.			No	No	Yes	No	No	No	No	7, 26
Flammulina velutipes (Curtis) Singer	*Collybia velutipes* (Curtis:Fr) Kumm.		Wide host range	No	No	Yes	No	No	No	No	26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Fomes fomentarius (L.) Kickx	*Agaricus fomentarius* (L.) Lam.; *Boletus fomentarius* L. *Pyropolyporus fomentarius* (L.) Teng	White spongy heart rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Fomitopsis pinicola (Sw.) Karst.	*Boletus pinicola* Sw.; *Fomes pinicola* (Sw.) Sr.; *Polyporus pinicola* (Sw.) Fr.; *Trametes pinicola* (Sw.) Karst.	Brown crumbly rot, heart rot	Wide host range	No	No	Yes	No	No	No	No	7, 8, 26
Fumago vagans Pers.	*Caldariomyces fumago* Woron.	Sooty mold		No	Yes	Yes	No	No	No	No	7, 26
Fusarium avenaceum (Corda ex Fr.) Sacc.	*Fusisporium avenaceum* Fr.; *Gibberella avenacea* Cooke	Storage rot, water rot	Wide host range	No	Yes	No	No	No	No	No	3, 26
Fusarium acuminatum Ellis & Everh.	*Fusarium gibbosum var. acuminatum* (Ellis & Everh.) Bilai; *Fusarium scirpi* Lamb. & Fautrey; *Fusarium scirpi var. acuminatum* (Ellis & Everh.) Wollenw.; *Gibberella acuminata* Booth	Rot		No	No	Yes	Yes	No	No	No	7, 26
Fusarium equiseti (Corda) Sacc.	*Fusarium gibbosum* Appel & Wollenw.; *Fusarium roseum var. gibbosum* (Appel & Wollenw.) Messiaen & Cass.; *Gibberella intricans* Wollenw.; *Selenosporium equiseti* Corda;	Rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Fusarium heterosporum Nees:Fr.	*Fusarium graminum* Corda; *Gibberella gordonii* Booth	Rot		No	No	Yes	No	No	No	No	7, 26
Fusarium oxysporum Schltdl.	*Fusarium angustum* Sherb.; *Fusarium bulbigenum* Cooke & Massee	Root rot	Wide host range	No	No	No	Yes	Yes	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Fusarium roseum Link	*Botryosphaeria saubinetii* (Mont.) Niessl; *Dothidea zeae* (Schwein.) Schwein.; *Fusarium graminearum* Schwabe; *Gibberella roseum* (Link) Snyder & Hansen; *Gibberella zeae* (Schwein.) Petch; *Sphaeria zeae* Schwein.		Wide host range	No	No	Yes	No	No	No	No	7, 26
Fusarium solani (Mart.) Sacc. Snyder & Hansen	*Fusisporium solani* Martius; *Nectria haematococca* Berk. & Broome	Storage rot, root rot	Wide host range	No	Yes	No	Yes	Yes	No	No	3, 4, 26
Fusicladium alopecuri Ellis & Everh.	*Cladosporium alopecuri* (Ellis & Everh.) Braun		*Alopecurus*	No	No	Yes	No	No	No	No	7, 26
Fusicladium asperatum Schub. & Braun			*Acantharia*	No	No	Yes	No	No	No	No	7, 26
Fusicoccum africanum Van der Byl				No	No	Yes	No	Yes	No	No	7, 26
Fusicoccum luteum Pennycook & Samuels				No	No	No	No	No	No	No	7
Fusicoccum microspora Muthappa				No	No	Yes	No	No	No	No	7
Fusicoccum pyrorum Chupp & Clapp		Canker		No	No	Yes	No	No	No	No	7, 26
Ganoderma applanatum (Pers.) Pat.	*Boletus applanatus* Pers.; *Fomes applanatus* (Pers.) Gillet; *Phaeoporus applanatus* (Pers.) JSchröt.; *Polyporus applanatus* (Pers.) Wallr.	Rot	Wide host range	No	No	Yes	No	No	No	No	7, 26

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Ganoderma lucidum (Curtis) Karst.	*Boletus lucidus* Curtis; *Fomes lucidus* (Curtis) Cooke; *Ganoderma curtisii* (Berk.) Murrill; *Polyporus curtisii* Berk.; *Polyporus lucidus* (Curtis) Fr.	White root, butt rot		No	No	No	Yes	No	No	No	7, 26
Geastrumia polystigmatis Bar. & Farr		Sooty blotch		No	No	Yes	No	No	No	No	7, 26
Geotrichum candidum Link	*Galactomyces geotrichum* (Butler & Petersen) Redhead & Malloch; *Oidium lactis* Thüm.; *Oospora lactis* (Thüm.) Sacc.; *Oospora mali* Kidd & Beaumont; *Oospora piricola* Mangin		*Citrus*, *Prunus*	No	Yes	No	No	No	No	No	7, 26
Gilbertella persicaria (Eddy) Hesseltine	*Choanephora persicaria* Eddy;	Fruit rot	*Pyrus*, *Prunus*	No	Yes	No	No	No	No	No	7, 26, 69
Glibberella baccata (Wallr.) Sacc.	*Fusarium lateritium* Nees; *Glibberella moricola* (De Not.) Sacc.	Die bak, canker, fruit rot		No	Yes	Yes	No	No	No	No	26, 74
Gliocladium viride Matr.	*Gliocladium deliquescens* Sopp		*Metrosideros*	Yes	No	No	No	No	No	No	7, 26, 30
Gloeocystidiellum sacratum (Cunn.) Stalpers & Buchanan	*Amylostereum sacratum* (Cunn.) Burds.; *Dextrinocystidium sacratum* (Cunn.) Sheng Wu; *Peniophora sacrata* Cunn.; *Phanerochaete sacrata* (Cunn.) Taylor	Peniophora root canker		No	No	No	Yes	No	No	No	7, 26
Gloeodes pomigena (Schwein.) Colby	*Dothidea pomigena* Schwein.; *Marssonina coronariae* (Sacc. & Dearn.) Davis; *Marssonia mali* Henn.; *Leptothyrella mali* (Henn.) Hara; *Phyllachora pomigena* (Schwein.) Sacc.;	Soothy Blotch	Wide host range	No	Yes	Yes	No	Yes	No	No	7, 12, 26, 27, 74

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Gloeophyllum sepiarium (Wulfen) Karst.	*Lenzites sepiaria* (Wulfen) Fr.	Sapwood rot		No	No	Yes	No	No	No	No	7, 26
Gloeophyllum trabeum (Pers.) Murrill	*Lenzites* trabea (Pers.) Fr.; *Lenzites* trabeus (Pers.) Bres.; *Lenzites* vialis Peck; *Trametes* trabea (Pers.) Bres.	Wood decay	Wide host range	Yes	No	No	No	No	No	No	7, 26
Glomerella cingulata (Stoneman) Spaulding & Schrenk	*Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc.; *Gloeosporium rufomaculans* (Berk.) Thüm; *Glomerella miyabeana* (Fukushi) Arx; *Glomerella rubicola* (Stoneman) Spauld. & Schrenk; *Glomerella rufomaculans* (Berk.) Spauld. & Schrenk;	Bitter rot, anthracnose, die back	Wide host range	No	Yes	Yes	No	Yes	No	No	7, 8, 12, 26, 30, 40, 74
Gloniopsis praelonga (Schwein.) Underw. & Earle	*Gloniopsis verbasci* (Schwein.) Rehm; *Hysterium praelongum* Schwein.; *Hysterographium praelongum* (Schwein.) Sacc.		Wide host range	No	No	Yes	No	No	No	No	7, 26
Glyphium corrugatum (Ellis & Everh.) Goree	*Acrospermum corrugatum* Ellis		Wide host range	No	No	Yes	No	No	No	No	7, 26
Grandinia spathulata (Schrad.:Fr.) Julich	*Hyphodontia spathulata* (Schrad.) Parmasto; *Hydnum spathulatum* Schrad.; *Kneiffiella spathulata* (Schrad.) Jülich & Stalpers	White rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Gymnosporangium clavariiforme (Jacq.) DC.	*Gyraria juniperina* (Wahlenb.) Gray; *Roestelia lacerata* Mérat; *Tremella clavariiformis* Jacq.; *Tremella juniperina* Wahlenb.	Hawthorn rust	*Amelanchie, Crataegus, Cudonia, Juniperus, Pyrus*	No	No	Yes	No	No	No	Yes	7, 26

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Gymnosporangium clavipes (Cook & Peck) Cook & Peck	*Caeoma germinale* Schweinitz; *Gymnosporangium germinale* Kern; *Podisoma gymnosporangium-clavipes* Cook & Peck; *Roestelia aurantiaca* Peck	Quince Rust	*Amelanchier, Aronia, Chaenomele, Crataegus, Cydonia, Mespilus, Juniperus, Photinia*	No	Yes	Yes	No	No	Yes	No	7, 8, 19, 26, 33
Gymnosporangium globosum (Farlow) Farlow	*Gymnosporangium fuscum var. globosum* Farlow	Hawthorn rust	*Crataegus, Pyrus, Sorbus, Juniperus, Amelanchier*	No	No	Yes	No	No	Yes	No	7, 8, 20, 26, 30, 34
Gymnosporangium juniperi-virginianae Schwein.	*Aecidium pyrolatum* Schwein; *Gymnosporangium macropus* Link; *Gymnosporangium virginianum* Sprengel; *Roestelia pyrata* Thaxter	Cedar-apple rust	*Crataegus, Juniperus*	No	Yes	Yes	No	No	Yes	No	7, 8, 20, 21, 26, 30, 35
Gymnosporangium libocedri (Henn.) Kern	*Aecidium blasdaleanum* Dietel & Holway; *Gymnosporangium aurantiacum* Sydow; *Gymnosporangium blasdaleanum* Kern; *Phragmidium libocedri* Henn.		*Amelanchie, Crataegus, Pyrus, Cydonia, Calocedrus, Sorbus*	No	Yes	Yes	No	No	No	Yes	7, 26, 36
Gymnosporangium nelsonii Arthur	*Gymnosporangium corniculans* Kern		*Amelanchie, Crataegus, Pyrus, Cydonia, Juniperus, Sorbus*	No	No	Yes	No	No	No	Yes	7, 26
Gymnosporangium nidus-avis Thaxt	*Gymnosporangium juvenescens* Kern		*Amelanchie, Cydonia, Juniperus*	No	No	Yes	No	No	No	Yes	7, 26
Gymnosporangium nootkatense Arthur	*Gymnotelium nootkatense* (Arthur) Syd.		*Amelanchier, Sorbus*	No	No	Yes	No	No	No	Yes	7, 26
Gymnosporangium tremelloides Hartig	*Roestelia penicillata* Fr.	European apple rust	*Sorbus Cydonia, Juniperus*	No	Yes	Yes	No	No	No	Yes	7, 37

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Gymnosporangium yamadae Miyabe ex Yamada		Japanese apple rust	*Juniperus*	No	No	Yes	No	No	Yes	No	7, 8, 38, 22
Haplotrichum conspersum (Link) Hol.-Jech.	*Botryobasidium conspersum* JErikss.; *Oidium conspersum* (Link) Linder		*Betula, Fagus, Quercus*	No	No	Yes	No	No	No	No	7, 26
Helicobasidium brebissonii (Desmaz) Donk	*Helicobasidium purpureum* (Tul.) Pat.; *Rhizoctonia crocorum* (Pers:Fr) DC.; *Sclerotium crocorum* Pers.	Violet root rot		No	No	No	Yes	No	No	No	7, 26
Helicobasidium mompa Tanaka	*Septobasidium mompa* (Tanaka) Racib.	Violet root rot	Wide host range	No	No	No	Yes	No	No	Yes	1, 7, 26
Helminthosporium papulosum A Berg		Black pox, leaf spot	*Pyrus*	No	Yes	Yes	No	No	No	Yes	1, 7, 26, 30
Hendersonia cydoniae Cooke & Ellis			*Cydonia, Pyrus*	No	No	Yes	No	No	No	No	7, 26
Hendersonia piricola Sacc	*Leptocoryneum piricola* (Sacc.) Petr.; Leptocoryneum piricolum (Sacc.) Petr.			No	No	No	No	No	No	No	7, 26
Heterobasidion annosum (Fr.) Bref.	*Boletus annosus* (Fr.) Spreng.; *Fomes annosus* (Fr.) Cooke; *Placodes annosus* (Fr.) Quél.; *Polyporus annosus* Fr.; *Spiniger meineckellum* (Olsen) Stalpers *Trametes annosa* (Fr.) Otth	Root rot	Wide host range	No	No	Yes	Yes	No	No	No	7, 26
Heterosporium maculatum Klotzsch			*Typha*	No	No	Yes	No	No	No	No	7, 26
Hexagonia tenuis Hook				No	No	No	No	No	No	No	7, 26

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Hydnum ochraceum Pers.	*Climacodon ochraceus* (Pers.) Karst.; *Irpex ochraceus* (Pers.) Kotir. & Saaren.; *Leptodon ochraceus* (Pers.) Quél.; *Steccherinum ochraceum* (Pers.) Gray	Sapwood rot		No	No	No	No	No	No	No	7, 26
Hydnum setosum Pers.	*Acia setosa* (Pers.) Bourdot & Galzin; *Mycoacia setosa* (Pers.) Donk; *Oxydontia setosa* (Pers.) Mill. *Sarcodontia setosa* (Pers.) Donk		*Crataegus, Prunus*	No	No	No	No	No	No	No	7, 26
Hymenochaete agglutinans Ellis	*Corticium corrugatum* (Fr.) Fr.; *Hymenochaete corrugata* (Fr.) L; *Stereum corrugatum* (Fr.) Quél.; *Thelephora corrugata* Fr.; *Xerocarpus corrugatus* (Fr.) Karst.	Stem canker	Wide host range	No	No	Yes	No	No	No	No	7, 26
Hypholoma fasciculare (Huds.) Quél.	*Agaricus fascicularis* Huds.; *Naematoloma fasciculare* (Huds.) Karst.; *Psilocybe fasciculare* (Huds.) Kühner		Wide host range	No	No	No	No	No	No	No	7, 26
Hypholoma sublateritium (Schaeff.) Quél.	*Agaricus sublateritius* Schaeff.; *Dryophila sublateritia* (Schaeff.) Quél.; Naematoloma sublateritium (Schaeff.) Karst.			No	No	No	No	No	No	No	7, 26
Hypoxylon atropunctatum (Schwein.) Cooke	*Biscogniauxia atropunctata* (Schwein.) Pouzar; *Diatrype atropunctata* (Schwein.) Berk.; *Numulariola atropunctata* (Schwein.) House; *Sphaeria atropunctata* Schwein.	Sapwood rot		No	No	No	No	No	No	No	7, 26

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Hypoxylon howeianum Peck	*Hypoxylon coccineum sensu* Plowright; *Hypoxylon variolosum var. microcarpum* (Bizz.) Traverso; *Hypoxylon coccinellum* Sacc.; *Hypoxylon daldiniiforme* Martin	Sapwood rot	Wide host range	No	No	No	No	No	No	No	7, 26
Hypoxylon mammatum (Wahlenberg) Miller	*Anthostoma blakei* (Berk. & Curtis) Reed{?} & Farr; *Entoleuca mammata* (Wahlenb.) Rogers & Ju; *Hypoxylon pruinatum* (Klotzsch) Cooke; *Nemania mammata* (Wahlenb.) Granmo; *Rosellinia pruinata* (Klotzsch) Sacc.	Canker	Wide host range. Important pathogen of *Populus*	No	No	Yes	No	No	No	Yes	1, 7, 26
Hypoxylon mediterraneum (De Not.) Ces & De Not.	*Biscogniauxia mediterranea* (De Not.) Kuntze; *Nummullaria mediterranea* (De Not.) Martin; *Nummullaria repandoides* Fuckel; *Sphaeria mediterranea* De Not.		Wide host range	No	No	Yes	No	No	No	No	7, 26, 28, 29
Hypoxylon rubiginosum (Pers.) Fr.	*Hypoxylon perforatum* (Schwein.) Fr. *Sphaeria rubiginosa* Pers.; *Stromatosphaeria rubiginosa* (Pers.) Grev.	Sapwood rot		No	No	No	No	No	No	No	7, 26
Hypoxylon serpens (Pers.) Fr.	*Gamosphaera serpens* (Pers.) Dumort.; *Geniculosporium serpens* Chesters & Greenh.; *Hypoxylon subluteum* Ellis & Everh. *Nemania serpens var. serpens* (Pers.) Gray; *Sphaeria serpens* Pers.	Sapwood rot		No	No	No	No	No	No	No	7, 26

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Hypsizygus ulmarius (Bull.) Redhead	*Agaricus ulmarius* Bull.; *Lyophyllum ulmarium* (Bull.) Kühner; *Pleuropus ulmarius* (Bull.) Gray; *Pleurotus pantoleucus* sensu auct. brit.; *Pleurotus ulmarius* (Bull.) Kumm.	Wound rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Hysterium pulicare Ellis	*Hysterium acervulatum* Schwein.; *Hysterium teres* Schwein.		*Betula, Eucalyptus, Quercus*	No	No	No	No	No	No	No	7, 26
Illosporium malifoliorum Sheld.		Leaf spot		No	No	Yes	No	No	No	No	7, 26
Inonotus hispidus (Bull.: Fr.) Karsten	*Inonotus hirsutus* (Scop.); *Polyporus endocrocinus* Berk.; *Polyporus hispidus* (Bull) Fr.; *Xanthochrous hispidus* (Bull.) Fr. Pat.	Heart Rot	Wide host range	No	No	No	No	No	No	No	7, 8, 26, 30, 48
Irpex lacteus (Fr.) Fr.	*Boletus tulipiferae* Schwein.; *Irpex tulipiferae* (Schwein.) Schwein. *Hirschioporus lacteus* (Fr.) Teng; *Polyporus tulipiferae* (Schwein.) Overh.; *Steccherinum lacteum* (Fr.) Krieglst.; *Trametes lactea* (Fr.) Pilát		Wide host range	No	No	Yes	No	No	No	No	7, 26
Jattaea microtheca (Cooke & Ellis) Berl.	*Calosphaeria microtheca* (Cooke & Ellis) Sacc.; *Circinostoma microthecum* (Cooke & Ellis) House; *Physalospora microtheca* (Cooke & Ellis) Sacc.; *Sphaeria microtheca* Cooke & Ellis		*Populus, Quercus, Vaccinium*	No	No	Yes	No	No	No	No	7, 26
Lachnella alboviolascens (Alb. & Schwein.) Fr.	*Peziza alboviolascens* Alb. & Schwein.			Yes	No	No	No	No	No	No	7, 26

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Laetiporus sulphureus (Bull.) Murrill	*Boletus sulphureus* Bull.; *Laetiporus cincinnatus* (Morgan) Burds.,Banik & Volk; *Polyporus sulphureus* (Bull.) Fr.; *Sporotrichum versisporum* (Lloyd) Stalpers; *Tyromyces sulphureus* (Bull.) Donk	Sapwood rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Lasiodiplodia theobromae (Pat.) Griffon & Maubl.	*Botryodiplodia ananassae* (Sacc.) Petr.; *Botryodiplodia elasticae* Petch; *Botryodiplodia theobromae* Pat.; *Diplodia theobromae* (Pat.) Nowell; *Lasiodiplodiella triflorae* (Higgins) Zambett.; *Macrophoma vestita* Prill. & Delacr.		Wide host range	No	No	Yes	No	No	No	No	7, 26
Laxitextum bicolor (Pers.) Lentz	*Lloydella fusca* (Schrad.) Bres.; *Stereum bicolor* (Pers.) Pat.; *Stereum fuscum* (Schrad.) Karst.; *Stereum laxum* Lloyd; *Thelephora bicolor* Pers.		Wide host range	No	No	Yes	No	No	No	No	7, 26
Lecanidion atratum (Hedw.) Rabenh.	*Bacidia sublubens* (Paulson) Zahlbr.; *Bilimbia sublubens* Paulson; *Lichen atratus* Hedw.; *Patellaria atrata* (Hedw.) Fr.; *Patellaria maura* Massee		Wide host range	No	No	Yes	No	No	No	No	7, 26
Lenzites betulina (L.) Fr.	*Agaricus coriaceus* sensu auct.; *Cellularia betulina* (L.) Kuntze; *Daedalea betulina* (L.) Rebent.; *Merulius betulinus* (L.) Wulfen; *Sesia hirsuta* (Schaeff.) Murrill	Sapwood rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Leptosphaeria concentrica Ellis & Everh.	*Paraphaeosphaeria concentrica* (Ellis & Everh.) Huhndorf			No	No	No	No	No	No	No	7, 26

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Leptosphaeria mandshurica Miura		Leaf spot		No	No	Yes	No	No	No	Yes	7, 26
Leptosphaeria pomona Sacc.	*Lepthosphaeria yulan*; *Phaeosphaeria pomona* (Sacc.) Huhndorf	Leaf spot		No	No	No	No	No	No	Yes	1, 7
Leucostoma auerswaldii (Nitschke) Hohn	*Anthostoma auerswaldii* Niessl; *Cytospora personata* (Fr.) Sacc.; *Leucocytospora personata* (Fr.) Hohn; *Sphaeria personata* Fr.; *Valsa auerswaldii* Nitschke	Leucostoma canker		No	No	Yes	No	No	No	Yes	1, 7, 26
Leucostoma cincta (Fr.) Hohn	*Cytospora cincta* Sacc.; *Cytospora rubescens* Fr.; *Leucostoma cinctum* (Fr.) Höhnel; *Leucocytopora cincta* Sacc. Hohn; *Sphaeria cincta* Curr.; *Valsa cincta* (Fr.:Fr.) Fr. *Valsaria cincta* (Curr.) Sacc.; *Valsaria insitiva* (Tode) Ces. & De Not.	Leucostoma canker	*Crataegus, Prunus*	No	No	Yes	No	No	No	Yes	1, 7, 26, 30
Leucostoma persoonii (Nitschke) Höhn.	*Cytospora leucostoma* (Pers.) Sacc.; *Leucostoma leucostoma* (Pers.) Togashu{?}; *Sphaeria leucostoma* Pers.; *Valsa leucostoma* (Pers.) Fr.; *Valsa persoonii* Nitschke	Canker, die back	*Cydonia, Populus, Prunus, Pyrus, Sorbus*	No	No	Yes	No	Yes	No	No	7, 12, 26, 27
Lophiostoma holmiorum Barr & Math				No	No	Yes	No	No	No	No	7, 26
Lophiostoma vicinum Sacc.	*Ostropella vicina* (Sacc.) E. Müll.			No	No	Yes	No	No	No	No	7, 26
Macroplodia cinerea Cooke & Ellis	*Cytoplea cinerea* (Cooke & Ellis) Petr. & Syd.; *Sphaeropsis cinerea* (Cooke & Ellis) Sacc.			No	No	Yes	No	No	No	No	7, 26

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Maireina marginata (McAlpine) Cooke	*Cyphella marginata* McAlpine		*Prunus*	No	No	Yes	No	No	No	No	7, 26
Marasmius minutus Peck	*Marasmius pyrinus* Ellis			No	No	No	No	No	No	No	7, 26
Massaria pyri Otth	*Aglaospora occulta* (Ellis) Farl.; *Massaria pruni* Wehmeyer			No	No	Yes	No	No	No	No	1,7, 26
Melanochaeta hemipsila (Berk. & Broome) Müll., Harr & Sulmont	*Chaetosphaeria hemipsila* (Berk. & Broome) Petch; *Lasiosphaeria hemipsila* (Berk. & Broome) Sacc.; *Sphaeria hemipsila* Berk. & Broome; *Sporoschisma saccardoi* Mason & Hughes			No	No	No	No	No	No	No	7, 26
Melanopsamma improvisa (Karst.) Sacc	*Melanomma improvisum* (Karst.) Sacc.; *Sphaeria improvisa* Karst.; *Zignoëlla improvisa* (Karst.) Sacc.			No	No	Yes	No	No	No	No	7, 26
Melanopsamma pomiformis (Pers.) Sacc.	*Chaetosphaeria pomiformis* (Pers.) E. Müll.; *Sphaeria coronata* Sowerby; *Sphaeria pomiformis* Pers.; *Stachybotrys socia* (Sacc.) Sacc.		*Juncus*	No	No	No	No	No	No	No	7, 26
Merulius rufus Pers.	*Phlebia rufa* (Pers.) Christ.; *Serpula rufa* (Pers.) Karst.; *Sesia rufa* (Pers.) Kuntze; *Xylomyzon rufum* (Pers.) Pers.			No	No	No	No	No	No	No	7, 26
Merulius tremellosus Schrad.	*Phlebia tremellosus* (Schrad.) Nakasone & Burds.; *Merulius imbricatus* Balf.-Browne; *Xylomyzon tremellosum* (Schrad.) Pers.		Wide host range	No	No	No	No	No	No	No	7, 26
Microsphaeropsis ochracea Carisse & Bernier				Yes	No	No	No	No	No	No	7, 26

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Mirandina breviphora Matsush.				No	No	No	No	No	No	No	7, 26
Mollisia caespiticia Karst.	*Pyrenopeziza caespiticia* (Karst.) Gremmen		*Alnus*	No	No	Yes	No	No	No	No	7, 26
Monilinia fructicola (Winter.) Honey	*Ciboria fructicola* Winter; *Sclerotinia fructicola* (Winter) Rehm	Brown rot	*Prunus, Pyrus, Chaenomeles Crataegus, Cydonia, Eriobotrya*	No	Yes	Yes	No	No	Yes	No	7, 9, 23, 26
Monilinia fructigena Honey ex Whetzel	*Monilia fructigena* (Pers) Fr.; *Oidium fructigenum* (Bonord.) Schröt.; *Sclerotinia fructigena* Aderh.; *Sporidesmium fructigenum* Ellis & Everh.; *Stromatinia fructigena* (Schröt.) Boud.; *Sclerotinia fructigena* Aderhold & Ruhl.	Brown rot	*Pyrus, Cydonia, Prunus*	No	Yes	Yes	No	No	No	Yes	1, 7, 8, 26, 30
Monilinia laxa (Aderhold & Ruhland) Honey ex Whetzel	*Monilia cinerea* Woronin; *Monilia laxa* (Ehrenb.) Sacc.; *Sclerotinia cinerea* (Bonord.) Schröt; *Sclerotinia cerasi* Woronin; *Sclerotinia laxa* Aderh. & Ruhland	Blossom blight, Brown rot	*Cydonia, Prunus, Pyrus*	No	Yes	Yes	No	Yes	No	No	7, 8, 26
Monilinia mali (Takah.) Whetzel	*Sclerotinia mali* Takah.	Leaf blight		No	No	Yes	No	No	No	Yes	7, 26
Monochaetia concentrica (Berk. & Broome) Sacc. & Sacc.	*Pestalotia concentrica* Berk. & Broome	Leaf spot		No	No	Yes	No	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Monochaetia unicornis (Cooke & Ellis) Sacc.	*Cryptostictis cupressi* Guba; *Monochaetia mali* (Ellis & Everh.) Sacc. & Sacc.; *Lepteutypa cupressi* (Nattrass, Booth & Sutton); *Pestalotia unicornis* Cooke & Ellis; *Pestalotia mali* Ellis & Everh.; *Seiridium unicorne* (Cooke & Ellis) Sutton	Apple twig canker, Monochaetia canker		No	No	Yes	No	No	No	No	7, 26
Monodictys melanopa (Ach. ex Turner) Ellis	*Piricauda melanopus* (Berk. & Broome) Moore; *Spiloma melanopum* Ach. ex Turner; *Sporidesmium melanopum* (Ach.) Berk. & Broome			No	No	No	No	No	No	No	7, 26
Mucor piriformis Fischer	*Hydrophora fischeri* Sumst.; Mucor alboater Naumov; *Mucor alboater var. sphaerosporus* Naumov; *Mucor wosnessenskii* Schostak.	Fruit rot	Wide host range	Yes	Yes	No	No	Yes	No	No	7, 26, 30
Mucor racemosus Fres.	*Mucor oudemansii* Vánová	Mucor rot, fruit rot	*Carya, Citrus, Ipomoea, Nicotiana, Zea*	No	Yes	No	No	No	No	No	7, 26, 30
Mycena citricolor (Berk. & Curtis) Sacc.	*Decapitatus flavidus* (Cooke) Redhead & Seifert; *Mycena flavida* (Maubl. & Rangel) Singer; *Stilbella flavidum* (Cooke) Henn.; *Stilbum flavidum* Cooke		*Coffea*	No	No	Yes	No	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Mycosphaerella pomi (Pass.) Lindau	*Cylindrosporium pomi* Brooks; *Phoma macrostoma* Mont.; *Phoma mali* Schulzer & Sacc.; *Phoma pomi* Schulzer & Sacc.; *Phyllosticta limitata* Peck; *Phyllosticta mali* Prill. & Delacr.: *Sphaerella pomi* Pass.	Brooks spot, Fruit spot, Phomo fruit spot	*Cydonia*	No	Yes	Yes	No	Yes	No	No	7, 12, 26, 27
Mycosphaerella pyri (Auersw.) Boerema	*Mycosphaerella sentina* (Fr.) Schröt. *Phaeosphaerella sentina* (Fr.) Verpl.; *Septoria pyri* Castagne; *Septoria pyricola* Desm. *Sphaerella sentina* Fuckel *Sphaeria sentina* Fr.	Leaf spot, canker		No	No	Yes	No	Yes	No	No	7, 26
Mycosphaerella tassiana (De Not.) Johanson	*Cladosporium herbarium* (Pers.) Link *Davidiella tassiana* (De Not.) Crous & Braun; *Mycosphaerella tulasnei* (Jancz.) Lindau; *Sphaerella tulasnei* Jancz.	Fruit rot	Wide host range	No	Yes	Yes	No	Yes	No	No	7, 26, 30
Mycothyridium lividum (Pers.) Petr.	*Sphaeria livida* Pers.; *Thyridium lividum* (Pers.) Sacc.; *Xylosphaeria livida* (Pers.) Stev.		Acer	No	No	Yes	No	No	No	No	7, 26
Myriangium superficialis (Peck & Clinton) Barr	*Cenangium asterinospora* Ellis & Everh.; *Fenestella superficialis* (Cooke & Peck) Sacc.; *Melogramma superficialis* Cooke & Peck;		*Crataegus, Sorbus, Vaccinium*	No	No	Yes	No	No	No	No	7, 26
Nectria cinnabarina (Tode) Fr.	*Cucurbitaria cinnabarina* (Tode) Grev.; *Knyaria vulgaris* (Tode) Kuntze; *Nectria ochracea* Grev. & Fr.; *Sphaeria cinnabarina* Tode; *Sphaeria ciliocea* Grev. ex Fr.; *Tubercularia vulgaris* Tode	Twig blight, branch canker, coral spot		No	No	Yes	No	Yes	No	No	7, 12, 13, 26

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Nectria ditissima Tul. & C. Tul.	*Cylindrocarpon willkommii* (Lindau) Wollenw.;) *Fusarium willkommii* Lindau; *Nectria major* (Wollenw.) Moravec	Canker	Wide host range	No	No	Yes	No	No	No	No	7, 26
Nectria sanguinea (Sibth.) Fr.	*Sphaeria sanguinea* Sibth.		*Ceanothus, Liquidamba, Lupinus, Salis*	No	No	Yes	No	No	No	No	7, 26
Nectria vulpina (Cooke) Cooke	*Dialonectria vulpina* (Cooke) Cooke; *Lasionectria vulpina* (Cooke) Rossman & Samuels; *Nectriella vulpina* (Cooke) Berl. & Voglino; *Peziza vulpina* Cooke; *Polystigma vulpinum* (Cooke) Gola; *Solenopezia vulpina* (Cooke) Sacc.		*Acer*	No	No	No	No	No	No	No	7, 26
Nematogonum ferrugineum (Pers) Hughes	*Aspergillus aurantiacus* (Desm.) Berk.; *Nematogonum aurantiacum* Desm.		*Alnus*	Yes	No	No	No	No	No	No	7, 26
Neonectria coccinea (Pers.) Rossman & Samuels	*Cucurbitaria coccinea* (Pers.) Gray; *Cylindrocarpon candidum* (Link) Wolenweb.; *Nectria coccinea* (Pers.) Fr.; *Sphaeria coccinea* Pers.; *Sphaeria mori* Sowerby		Wide host range	No	No	Yes	No	No	No	No	7, 26

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Neonectria galigena (Bres.) Rossman & Samuels	*Cylindrocarpon heteronemum* (Berk. & Broome.) Wollenw.; *Cylindrocarpon mali* (Allesch.) Wollenw.; *Fusarium heteronemum* Berk. & Broome; *Fusarium mali* Allesch., *Nectria galligena* Bres.; *Ramularia heteronema* (Berk. & Broome) Wollenw.	Nectria canker, eye rot	Wide host range	No	Yes	Yes	No	No	Yes	No	1, 2, 7, 26
Nigrospora sphaerica (Sacc.) Mason	*Coniosporium extremorum* Syd. & Syd.; *Epicoccum hyalopes* Miyake; *Khuskia oryzae* H.J. Huds.; *Trichosporium sphaericum* Sacc.	Fruit rot	Wide host range	Yes	No	No	No	No	No	No	7, 26, 30, 32
Nodulisporium hinnuleum Smith		Fruit rot	*Carya, Platanus*	No	Yes	No	No	No	No	No	6, 7
Ochroporus ossatus Fisch.		White rot		Yes	No	No	No	No	No	No	7, 26
Ochropsora ariae (Fuckel) Ramsb.	*Aecidium leucospermum sensu auct.*; *Caeoma sorbi* Oudem.; *Melampsora ariae* (Schleich.) Fuckel; *Melampsora sorbi* Winter; *Ochropsora sorbi* Dietel; *Uredo ariae* Schleich.	Rust	*Anemone*	No	No	Yes	No	No	No	No	7, 26
Oidium pirinum Ellis & Everh.		Powdery mildew	*Crataegus*	No	No	Yes	No	No	No	No	7, 26
Omphalotus olearius (DC.:Fr) Singer	*Clitocybe illudens* (Schwein.) Sacc.; *Omphalotus illudens* (Schwein.) Bresinsky & Besl.		*Abies, Castanea, Olea, Quercus, Robibia*	No	No	Yes	No	No	No	No	7, 26
Oospora otophila Harz				No	No	Yes	No	No	No	No	7, 26

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Oothecium indicum Chaudhuri & Nath				No	No	Yes	No	No	No	No	7, 26
Otthia amica Sacc.Bommer & Rousseau	*Hendersonia diplodioides* Ellis & Everh.		*Sambucus*	No	No	Yes	No	No	No	No	7, 26
Oxyporus latemarginatus (Durieu & Mont.) Donk	*Chaetoporus ambiguus* (Bres.) Bondartsev & Singer; *Polyporus cokeri* Murrill; *Poria ambiqua* Bres. *Poria cokeri* Murrill; *Rigidoporus latemarginatus* (Durieu & Mont.) Pouzar; *Trametes latemarginata* (Durieu & Mont.) Pat.	White rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Panellus serotinus (Schrad.) Kühner	*Acanthocystis serotinus* (Schrad.) Konrad & Maubl.; *Hohenbuehelia serotina* (Pers.) Singer; *Panus serotinus* (Schrad.) Kühner; *Pleurotus serotinus* (Schrad.) P. Kumm.;		Wide host range	Yes	No	No	No	No	No	No	7, 26
Panellus stipticus (Bull.) Karst.	*Agaricus betulinus sensu* Bolton; *Agaricus flabelliformis* sensu Sowerby, Withering; *Panellus stipticus var. albidotomentosus* (Rea) Bi; *Panus stipticus* (Bull.:Fr.) Fr.		Wide host range	Yes	No	No	No	No	No	No	7, 26
Peltaster fructicola Johnson, Sutton & Hodges		Sooty blotch		No	Yes	Yes	No	No	No	No	7, 26

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Penicillium brevicompactum Dierckx	*Penicillium brunneostoloniferum* Abe; *Penicillium brunneostoloniferum* Abe ex Ramírez; *Penicillium stoloniferum* Thom; *Penicillium volgaense* Beliakova & Milko	Blue mold	*Acer, Carya, Citrus*	No	Yes	No	No	No	No	No	7, 26
Penicillium digitatum (Pers.) Sacc.	*Penicillium digitatoides* Sopp; *Monilia digitata* Pers.; *Mucor digitata* (Pers.) Mérat; *Penicillium lanosogrisellum* Sopp; *Penicillium olivaceum* Wehmer	Green mould	Wide host range	No	Yes	Yes	No	Yes	No	No	7, 8, 26, 45
Penicillium expansum Link	*Coremium glaucum* Link; *Coremium vulgare* Corda; *Floccaria glauca* Greville; *Penicillium crustaceum* Link; *Penicillium glaucum* Link	Blue mould	Wide host range	No	Yes	No	No	Yes	No	No	7, 26, 27, 30, 46
Penicillium funiculosum Thom	*Penicillium aurantiacum* Mill., Giddens & Foster; *Penicillium varians* Sm. *Penicillium rubicundum* Mill. Giddens & Foster;	Blue mold	Wide host range	No	Yes	No	No	Yes	No	No	7, 26
Penicillium glabrum (Wehmer) Westling	*Penicillium frequentans* Westling; *Penicillium terlikowskii* Zalessky			No	Yes	No	No	No	No	No	7, 26
Penicillium puberulum Bainer	*Penicillium aurantiogriseum* Dierckx; *Penicillium commune* Thom; *Penicillium verrucosum var. cyclopium* (Westling) Samson, Stolk & Hadlok	Blue mold	*Pyrus*	No	Yes	No	No	No	No	No	7, 26, 30
Penicillium rugulosum Thom	*Penicillium phialosporum* Udagawa; *Penicillium tardum* Thom	Blue mold		No	Yes	No	No	No	No	No	1, 7

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Penicillium solitum var. crustosum (Thom) Bridge, Hawksw., Kozak., Onions, Paterson & Sackin	*Penicillium crustosum* Thom; *Penicillium expansum var. crustosum* (Thom) Fassat.; *Penicillium farinosum* Novobr.; *Penicillium pseudocasei* Abe	Blue mold	*Pyrus*	No	Yes	No	No	No	No	No	1, 7
Penicillium spinulosum Thom	*Penicillium abeanum* Sm.; *Penicillium nigricans* Zalessky; *Penicillium spinuloramigenum* Sasaki ex Ramírez; *Penicillium spinuloramigenum* Sasaki; *Penicillium trzebinskii* Zalessky	Blue mold		No	Yes	No	No	No	No	No	7, 26
Penicillium verrucosum Dierckx	*Penicillium casei* Staub; *Penicillium gerundense* Ramírez & Martínez; *Penicillium verrucosum* (Dierckx) Samson, Stolk & Hadlokvar.	Blue mold	*Zea*	No	Yes	No	No	No	No	No	7, 26
Penicillium viridicatum Westling	*Penicillium olivinoviride* Biourge	Blue mold	*Zea*	No	Yes	No	No	No	No	No	7, 26
Peniophora cinerea (Pers.) Cooke	*Corticium obscurum* (Pers.) Fr.; *Peniophora obscura* (Pers.) Bres.; *Stereum tumulosum* (Karst.) Sacc.; *Terana obscura* (Pers.) Kuntze; *Xylobolus tumulosus* Karst.	Twig rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Perenniporia tenuis (Schwein.) Ryvarden	*Perenniporia medulla-panis f. tenuis* (Schwein.) Domanski; *Polyporus tenuis* Schwein.; *Poria tenuis* (Schwein.) Cooke; *Poria tenuis var pulchella* (Schwein.) Lowe	Wood decay	Wide host range	No	No	Yes	No	No	No	No	7, 26
Pestalotia disseminata Thüm.	*Pestalotiopsis disseminata* (Thüm.) Steyaert	Leaf spot	*Musa, Eucalyptus*	No	No	Yes	No	No	No	No	1, 7
Pestalotia hartigii Tub.	*Truncatella hartigii* (Tubeuf) Steyaert	Leaf spot, wilt root rot, fruit rot	*Purys*	No	Yes	Yes	Yes	No	No	No	7, 26, 30

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Pestalotia laurocerasi Westend.	*Pestalotiopsis laurocerasi* (Westend.) Chen; *Truncatella laurocerasi* (Westend.) Steyaert			No	No	No	No	No	No	No	7
Pestalotia malicola Hori	*Pestalotiopsis malicola* (Hori) Sun & Ge			No	No	No	No	No	No	No	7
Pestalotia malorum Elenkin & Ohl.				No	No	No	No	No	No	No	7
Pestalotia versicolor Speg.	*Pestalotiopsis versicolor* (Speg.) Steyaert	Fruit rot	*Persea*	No	Yes	No	No	No	No	No	7, 26
Pestalotiopsis japonica (Syd.) Steyaert	*Pestalotia japonica* Syd.			No	No	Yes	No	No	No	No	7, 26
Pezicula alba Guthrie	*Gloeosporium album* Osterw.; *Phlyctema vagabunda* Desm.; *Rhabdospora vagabunda* (Desm.) Zerov; *Trichoseptoria fructigena* Maubl.	Fruit rot	*Rubus, Sambucus*	No	Yes	No	No	Yes	No	No	7, 12, 26, 27
Pezicula corticola (Jörg.) Nannf.	*Neofabraea corticola* Jørg.	Canker		No	No	Yes	No	No	No	No	7, 26
Pezicula malicorticis (Jackson) Nannf.	*Cryptosporiopsis curvispora* (Peck) Gremmen; *Cryptosporiopsis malicorticis* (Cordley) Nannf.; *Cryptosporiopsis perennans* (Cordley) Nannf.; *Macrophoma curvispora* Peck *Neofabraea malicorticis* Jackson; *N. perennans* Kienholz; *Pezicula perennans* (Kienholz) Dugan, Roberts & Grove	Anthracnose, black spot canker, Bull's eye rot	*Pyrus, Prunus, Cydonia*	No	Yes	Yes	No	Yes	No	No	7, 8, 10, 26, 30
Pezicula polygona (Fuckel) Nannf.	*Cenangium polygonium* Fuckel; *Tympanis polygonia* (Fuckel) Sacc.			No	No	Yes	No	No	No	No	7, 26

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Pezicula pruinosa Farl.	*Cryptosporiopsis pruinosa* (Peck) Wollenw.; *Dermatea pruinosa* (Farl.) Petr.; *Glutinium macrosporum* Zeller; *Lagynodella pruinosa* (Peck) Petr.; *Sphaeronaema pruinosum* Peck.	Twig canker	*Amelanchier, Pyrus*	No	No	Yes	No	No	No	No	7, 26, 47
Peziza repanda Karst.	*Aleuria ampliata var. linteicola* (Phillips & Plowr.) Boud.; *Peziza pallida* Cooke & Peck.	Brown cup	Wide host range	No	No	Yes	No	No	No	No	7, 26
Pezizella oenotherae (Cooke & Ellis) Sacc.	*Discohainesia oenotherae* (Cooke & Ellis) Nannf.; *Helotium oenotherae* (Cooke & Ellis) Höhn.; *Mollisia oenotherae* (Cooke & Ellis) Seaver; *Pezizella lythri* (Desm.) Shear & Dodge		Wide host range	No	No	Yes	No	No	No	No	7, 26
Pezizella regalis (Cooke & Ellis) Sacc.	*Peziza regalis* Cooke & Ellis			No	No	Yes	No	No	No	No	7, 26
Phacidiopycnis washingtonensis Xiao *Rodgers*		Fruit rot	*Pyrus*	No	Yes	Yes	No	No	No	Yes	7, 26, 84
Phaeosclerotinia nipponica Hori	*Phaeosclerotinia phaeospora (Hori) Korf*			No	No	Yes	No	No	No	No	7, 26
Phanerochaete flavidoalba (Cooke) Rattan;	*Peniophora flavidoalba* Cooke; *Phlebia flavidoalba* (Cooke) Malençon & Bertault; *Phlebiopsis flavidoalba* (Cooke) Hjortstam		Wide host range	No	No	Yes	No	No	No	No	7, 26
Phellinus ferruginosus (Schrad.) Pat.	*Boletus ferruginosus* Schrad.; *Poria ferruginosa (Schrad.)* Karst.		Wide host range	No	No	Yes	No	No	No	No	7, 26

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Phellinus gilvus (Schwein.) Pat.	*Boletus gilvus* Schwein.; *Cerrena vittata* (Ellis & T. Macbr.) Zmitr.; *Fomes endozonus* (Fr.) G. Cunn.; *Fuscoporia gilva* (Schwein.) Wagner & Fisch.; *Polyporus gilvus* (Schwein.) Fr.; *Polyporus scruposus* Fr. *Polyporus gilvus* (Schwein.) Fr.	Sapwood rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Phellinus igniarius (L.) Quel	*Boletus igniarus* L.; *Fomes pomaceus* (Pers.) Lloyd; *Phellinus pomaceus* (Pers) Maire; *Polyporus fulvus* Scop.: Fr.	White trunk rot	Wide host range	No	No	Yes	No	No	No	No	7, 8, 26, 49
Phialophora malorum (Kidd & Beaumont) McColloch	*Cadophora malorum* (Kidd & Beaumont) Gams; *Sporotrichum carpogenum* Ruehle; *Sporotrichum malorum* Kidd & Beaumont	Side rot	*Pyrus*	Yes	Yes	Yes	No	No	No	No	7, 26, 30
Phlebia merismoides (Fr.) Fr.	*Irpex carneus sensu* Quelét; *Merulius merismoides* Fr.; *Phlebia aurantiaca var. radiata* (Fr.) Bourdot & Galzin; *Phlebia cinnabarina* Schwein. Phlebia radiata f. contorta (Fr.) Parmasto Phlebia radiata Fr.	Wrinkled Crust	Wide host range	No	No	Yes	No	No	No	No	7, 26
Pholiota adiposa (Fr.:Fr.) Kumm.	*Agaricus aurivellus* Batsch; *Dryophila aurivella* (Batsch) Quél; *Pholiota aurivella* (Batsch) Fr.; *Pholiota aurivella var. cerifera sensu auct.*; *Pholiota lilacifolia* P.D. Orton,	Brown cubical heart rot		No	No	Yes	No	No	No	No	7, 26

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Pholiota squarrosa (Weigel) Kumm.	*Agaricus squarrosus* Weigel; *Dryophila squarrosa* (Weigel) Quél.; *Lepiota squarrosa* (Weigel) Gray; *Pholiota jahnii sensu* Breitenbach & Kränzlin		*Betula, Populus, Salix*	No	No	Yes	No	No	No	Yes	7, 26
Phoma coonsii Boerema & Loer.				No	No	Yes	No	No	No	Yes	7, 26
Phoma fuliginea Kidd & Beaumont				No	No	Yes	No	No	No	No	7, 26
Phoma glomerata (Corda) Wollenw. & Hochapf.	*Coniothyrium glomerata* Corda; *Peyronellaea glomerata* (Corda) Goidanich; *Phoma alternariacearum* Brooks & Searle	Leaf and fruit spot	Wide host range	No	Yes	Yes	No	Yes	No	No	7, 41
Phoma pomorum Thüm. var. pomorum	*Coniothyrium prunicola* (Opiz ex Sacc.) Husz; *Coniothyrium pyrinum* (Sacc.) Sheld.; *Phoma bismarckii* Kidd & Beaumont; *Phoma pomorum* Thüm.; *Phyllosticta pyrina* Sacc.; *Peyronellaea pyrina* (Sacc.) Goid.; *Sphaceloma prunicola* (Sacc.) Jenkins	Leaf spot, twig blight, fruit spot, surfy bark	*Crataegus, Cydonia, Pyrus, Prunus*	No	Yes	Yes	No	No	No	Yes	7, 26, 31
Phoma pyrina (Fr.) Cooke	*Myxofusicoccum pyrinum* (Fr.) Boerema; *Sphaeria pyrina* Fr.		*Pyrus*	No	No	Yes	No	No	No	No	7, 26
Phoma radicina (McAlpine) Boerema	*Paraphoma radicina* (McAlpine) Morgan-Jones & White; *Pyrenochaeta radicina* McAlpine			No	No	Yes	No	No	No	No	7, 26
Phomopsis truncicola Miura				No	No	Yes	No	No	No	No	7, 26

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Phyllactinia guttata (Wallr.) Lév.	*Erysiphe betulae* DC.; *Phyllactinia corylea* (Pers.) Karst.; *Phyllactinia suffulta* (Rebent.) Sacc.	Powdery mildew	Wide host range	No	No	Yes	No	No	No	Yes	1, 7, 26
Phyllactinia mali (Duby) Braun	*Erysiphe guttata var. mespili* Castagne; *Erysiphe mali* Duby; *Phyllactinia mespili* (Castagne) Blumer	Powdery mildew		No	No	Yes	No	No	No	No	7, 26
Phyllactinia pyri (Castagne) Homma	*Erysiphe pyri* Castagne	Powdery mildew	*Pyrus*	No	No	Yes	No	No	No	Yes	1, 7, 26
Phyllosticta clypeata Ellis & Everh.				No	No	Yes	No	No	No	No	7, 26
Phyllosticta solitaria Ellis & Everhart	*Phyllostictina solitaria* (Ellis & Everh.) Shear	Apple blotch	*Crataegus*	No	Yes	Yes	No	No	No	Yes	7, 8, 24, 26, 30
Phyllosticta zonata Ellis & Everh.		Leaf spot		No	No	Yes	No	No	No	No	7, 26
Phyllotopsis nidulans (Pers.) Singer	*Crepidotus nidulans* (Pers.) Quél.; *Panellus nidulans* (Pers.) Pilát; *Panus nidulans* (Pers.) Pilát; *Pleurotus nidulans* (Pers.) P. Kumm.; *Pocillaria stevensonii* (Berk. & Broome) Kuntze			Yes	No	No	No	No	No	No	7, 26
Phymatotrichopsis omnivora (Duggar) Hennebert	*Hydnum omnivorum* Shear; *Ozonium auricomum* Link; *Ozonium omnivorum* Shear; *Phanerochaete omnivora* (Shear) Burds. & Nakasone; *Phymatotrichum omnivorum* Duggar	Phymatotrichum root rot	Wide host range	No	No	No	Yes	No	Yes	No	7, 8, 25, 26
Phytophthora boehmeriae Sawada		Root rot, leaf blight	*Boehemia, Citrus, Gossypium, Pinus*	No	Yes	No	Yes	No	No	Yes	7, 15, 26, 50

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Phytophthora cactorum (Lebert & Cohn) Schroeter	*Peronospora cactorum* Lebert & Cohn; *Peronospora sempervivi* Schenk; *Phloeophthora cactorum* (Lebert & Cohn) Wilson; *Phytophtora fagi* Hartig; *Phytophthora omnivora* de Bary	Fruit rot, collar rot and crown rot	Wide host range	No	Yes	Yes	Yes	Yes	No	No	7, 8, 12, 26, 51, 80
Phytophthora cambivora (Petri) Buisman	*Blepharospora cambivora* Petri	Root and collar rot.	Wide host range	No	No	Yes	Yes	No	No	Yes	7, 8, 14, 26, 52
Phytophthora cinnamomi Rands		Root rot	Wide host range	No	No	No	Yes	Yes	No	No	7, 12, 26, 53
Phytophthora citricola Sawada	*Phytophthora cactorum var. applanata* Chester; *Phytophthora pini* Leonian	Root rot	Wide host range	No	No	No	Yes	Yes	No	No	7, 26, 54, 81
Phytophthora citrophthora (Smith & Smith) Leonian	*Pythiacystis citrophthora* Smith & Smith; *Phytophthora imperfecta var. citrophthora* (Sm. & Sm.) Sarej	Trunk and crown canker	Wide host range	No	No	Yes	Yes	Yes	No	No	7, 12, 26, 55, 79
Phytophthora cryptogea Pethybridge & Lafferty		Root rot	Wide host range	No	No	Yes	Yes	Yes	No	No	6, 7, 8, 26, 56
Phytophthora drechsleri Tucker	*Phytophthora erythroseptica var. drechsleri* (Tucker) Sarej; *Pythium teratosporon* Sideris	Root rot, trunk canker	Wide host range	No	Yes	No	Yes	Yes	No	No	7, 12, 26, 57
Phytophthora gonapodyides (Petersen) Buisman	*Pythiomorpha gonapodyides* Petersen	Fruit rot	*Pyrus, Alnus*	No	Yes	Yes	No	No	No	Yes	7, 26, 58
Phytophthora hibernalis Carne		Root rot	*Citrus, Solanum, Lycopersicon*	No	No	No	Yes	No	No	Yes	7, 26, 59

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Phytophthora megasperma Drechsler	*Pythiomorpha miyabeana* Ito & Nagai	Root rot, trunk canker	Wide host range	No	No	Yes	Yes	Yes	No	Yes	7, 8, 60
Phytophthora nicotianae Breda de Haan	*Blepharospora terrestris* (Sherb.) Peyronel; *Phytophthora allii* Sawada; *Phytophthora parasitica* Dastur; *Phytophthora melongenae* Sawada; *Phytophthora nicotianae var. parasitica* (Dastur) Waterh.	Fruit rot, stem canker	Wide host range	No	Yes	Yes	Yes	Yes	No	No	7, 12, 26, 61
Phytophthora palmivora (Butler) Butler	*Kawakamia carica* Hara *Phytophthora omnivora* de Bary; *Phytophthora heveae* Thomps.; *Phytophthora carica* (Hara) Hori; *Pythium palmivorum* Butler; *Pythium theobromae* Coleman; *Pythium carica* Hara	Fruit rot	Wide host range	No	Yes	No	No	No	Yes	No	7, 26, 62
Phytophthora syringae (Klebahn) Klebahn.	*Nozemia syringae* (Klebahn) Pethybr.; *Ovularia syringae* Berk.; *Phloeophthora syringae* Klebahn	Fruit rot and collar rot, twig blight	*Citrus, Prunus, Pyrus, Syringa*	No	Yes	Yes	Yes	Yes	No	No	7, 12, 26, 74, 78
Pithomyces chartarum (Berk. & Curtis) Ellis	*Leptosphaerulina chartarum* Roux *Piricauda chartarum* (Berk. & Curtis) Moore; *Sporidesmium chartarum* Berk. & Curtis		Wide host range	Yes	No	No	No	No	No	No	7, 26
Pleomassaria mali Frolov				No	No	Yes	No	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Pleospora herbarum (Pers.) Rabenh. Ex Ces & de Not	*Alternaria putrefaciens* (Fuckel) Simmons; *Hendersonia mali* Thüm.; *Pleospora mali* Hesler; *Pleospora pomorum* Horne; *Pleospora fructicola* Ruehle; *Sphaeria herbarum* Pers.; *Stemphylium botryosum* Wallr.; *Stemphylium herbarum* Simmons	Pleospora Rot	Wide host range	No	Yes	Yes	No	Yes	No	No	7, 26, 30, 74
Pleurotus dryinus (Pers.) Kumm.	*Agaricus corticatus* Saunders; *Lentinus integer* Reichert; *Pleurotus corticatus* (Fr.) Kumm.		*Carya, Liquidambar, Quercus*	No	No	Yes	No	No	No	No	7, 26
Pleurotus ostreatus (Jacq.) Kumm.	*Pleurotus limpidus* (Fr.) Gill.; *Pleurotus salignus* (Pers.:Fr.) Kumm.	White rot	Wide host range	No	No	No	No	No	No	No	7, 26
Podosphaera clandestina (Wallr.) Lév.	*Erysiphe clandestina* Biv.; *Erysiphe oxyacanthae* DC.; *Podosphaera clandestina* (Wallr.) Lév.var. *clandestina; Podosphaera minor* Howe; *Podosphaera oxyacanthae* (DC.) de Bary	Powdery mildew		No	No	Yes	No	No	No	Yes	7, 26
Podosphaera leucotricha (Ellis & Everh.) Salmon	*Albugo leucotricha* (Ellis & Everh.) Kuntze; *Oidium farinosum* Cooke; *Oidium mespili* Cooke; *Sphaerotheca leucotricha* Ellis & Everh; *Sphaerotheca castagnei* Lev. *f. mali* Sorauer; *Sphaerotheca mali* Burr.	Powdery mildew	*Pyrus, Cydonia, Mespilus, Photinia*	No	Yes	Yes	No	Yes	No	No	7, 8, 12, 26, 27, 31
Polyporus admirabillis Peck	*Piptoporus fraxineus* Bondartsev & Ljub.; *Polyporus coronadensis* Gilb. & Martin; *Polyporus fraxineus* (Bondartsev & Ljub.) Dai; *Polyporus underwoodii* Murrill	Sapwood rot		No	No	Yes	Yes	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Polyporus badius (Pers.) Schwein	*Boletus badius* Pers.; *Polyporellus badius* (Pers.) Imazeki; *Polyporus durus* (Timm) Kreisel; *Polyporus fissus* Berk		Wide host range	No	No	Yes	No	No	No	No	7, 26
Polyporus ciliatus Fr.	*Boletus nummulariformis* Marchand; *Polyporus coerulescens* Velen.; *Polyporus zonatus* Velen.			No	No	Yes	No	No	No	No	7, 26
Polyporus fissilis Berk. & Curtis	*Aurantiporus fissilis* (Berk. & Curtis) Jahn ex Ryvarden; *Leptoporus fissilis* (Berk. & Curtis) Pilát; *Spongipellis fissilis* (Berk. & Curtis) Murrill; *Tyromyces fissilis* (Berk. & Curtis) Donk	Heart rot	Wide host range	No	No	Yes	No	No	No	Yes	7, 26
Polyporus galactinus Berk.	*Leptoporellus galactinus* (Berk.) Spirin; *Leptoporus galactinus* (Berk.) Pat.; *Spongipellis galactinus* (Berk.) Pat.; *Tyromyces galactinus* (Berk.) Bondartsev	Sapwood rot	Wide host range	No	No	Yes	No	No	No	Yes	7, 26
Polyporus hirsutus (Wulf.) Fr.	*Boletus hirsutus* Wulfen; *Coriolus hirsutus* (Wulf.) Quel.; *Daedalea polyzona* sensu auct.; *Trametes hirsuta* (Wulfen) Pilát	Wood rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Polyporus lacteus Fr.	*Bjerkandera lactea* (Fr.) Karst.; *Hemidiscia lactea* (Fr.) Lázaro Ibiza; *Leptoporus lacteus* (Fr.) Pat.; *Oligoporus lacteus* (Fr.) Gilb. & Ryvarden; *Spongiporus lacteus* (Fr.) Aoshima	Wood decay	Wide host range	No	No	Yes	No	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Polyporus leptocephalus (Jacq.) Fr.	*Boletus calceolus* sensu Withering; *Polyporus elegans* Fr.; *Polyporus leptocephalus f. nummularius* (Bull.) Courtec.; *Polyporus varius f. nummularius* (Bull.) Courtec.			Yes	No	No	No	No	No	No	7, 26
Polyporus resinosus (Schrad.) Fr.	*Boletus resinosus* Schrad.; *Fomitopsis resinosa* (Schrad.) Rauschert; *Ischnoderma resinosum* (Schrad.) Karst.;	Sapwood rot		No	No	Yes	No	No	No	No	7, 26
Postia caesia (Schrad.) Karst.	*Boletus caesius* Schrad.; *Oligoporus caesius* (Schrad.) Gilb. & Ryvarden; *Polyporus caesius* (Schrad.) Fr.; *Prillieuxia caesia* (Pers.) Park.-Rhodes; *Tyromyces caesia* (Schrad.:Fr.) Murrill	Sapwood rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Postia stiptica (Pers.) Jülich	*Agaricus albidus* (Schaeff.) Krause; *Boletus albidus* Schaeff.; *Oligoporus stipticus* (Pers.) Gilb. & Ryvarden; *Polyporus immitis* Peck *Polystictus stipticus* (Pers.) Bigeard & Guill.; *Tyromyces stipticus* (Pers.) Kotl. & Pouzar	Sapwood rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Postia tephroleuca (Fr.) Jülich	*Oligoporus tephroleucus* (Fr.) Gilb. & Ryvarden; *Piptoporus elatinus* (Berk.) Teng; *Polyporus tephroleucus* Fr.; *Spongiporus tephroleucus* (Fr.) David; *Tyromyces tephroleucus* (Fr.:Fr.) Donk		Wide host range	No	No	Yes	No	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Potebniamyces pyri (Berk. & Broome) Dennis	*Phacidiella discolor* (Mouton & Sacc.) Potebnia; *Phacidium discolor* Mouton & Sacc.; *Potebniamyces discolor* (Mouton & Sacc.) Smerlis; *Propolis pyri* (Berk. & Broome) Phillips; *Stictis lecanora var. pyri* Berk. & Broome	Fruit rot and canker	*Pyrus, Cydonia, Crataegus*	No	Yes	Yes	No	No	No	No	7, 26, 74
Psathyrella incerta (Peck) Sm.	*Agaricus incertus* Peck; *Hypholoma incertum* (Peck) Sacc.		*Acer, Carya, Ulmus*	No	No	Yes	No	No	No	No	7, 26
Pseudocercospora mali (Ellis & Everh.) Deighton	*Cercospora mali* Ellis & Everh.	Leaf spot		No	No	Yes	No	No	No	No	7, 26
Pulcherricium caeruleum (Lam.) Parmasto	*Byssus caerulea* Lam.; *Corticium caeruleam* (Schrad.:Fr.) Fr. *Terana caerulea* (Lam.) Kuntze		*Juglans, Quercus, Vitis*	No	No	Yes	No	No	No	No	7, 26
Punctularia strigosozonata (Schwein.) Talbot	*Auricula reflexa* (Berk.) Lloyd; *Phaeophlebia strigosozonata* (Schwein.) Cooke; *Phlebia strigosozonata* (Schwein.) Lloyd; *Stereum hispidulum* (Berk.) Cunn.; *Stereum strigosozonata* (Schwein.) Cunn.		*Populus*	No	No	Yes	No	No	No	No	7, 26
Pycnoporus cinnabarinus (Jacq.) Fr.	*Boletus miniatus* Libosch.; *Coriolus cinnabarinus* (Jacq.) Cunn.; *Fabisporus cinnabarinus* (Jacq.) Zmitr.; *Phellinus cinnabarinus* (Jacq.) Quél.; *Polyporus cinnabarinus* (Jacq.) Fr.; *Trametes cinnabarina* (Jacq.) Fr.		Wide host range	No	No	Yes	No	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Pyrenochaeta mali Smith		Fruit rot		No	Yes	No	No	No	No	No	7, 26, 30
Pythium abappressorium Paulitz & Mazzola				No	No	No	Yes	No	No	Yes	7, 26
Pythium arrhenomanes Drechsler	*Nematosporangium arrhenomanes* (Drechsler) Sideris		Wide host range	No	No	No	Yes	Yes	No	No	7, 26
Pythium debaryanum Hesse	*Eupythium debaryanum* (R. Hesse) Nieuwl.	Damping off	Wide host range	No	No	No	Yes	Yes	No	No	7, 8, 26
Pythium diclinum Tokun.	*Nematosporangium gracile* (Schenk) Jacz.; *Pythium gracile* Schenk			No	No	No	Yes	No	No	No	7, 26
Pythium echinulatum Matthews		Root rot		No	No	No	Yes	No	No	No	7, 26
Pythium intermedium de Bary	*Artotrogus intermedius* (de Bary) Atk.		Wide host range	No	No	No	No	No	No	No	7, 26
Pythium irregulare Buisman		Replant disease	Wide host range	No	No	Yes	Yes	Yes	No	No	7, 8, 12, 26
Pythium mamillatum Meurs		Fruit rot, root rot	*Ananas, Medicago, Pelargonium, Saccharum*	No	Yes	No	Yes	No	No	No	7, 26
Pythium middletonii Sparrow	*Eupythium proliferum* (de Bary) Nieuwl.; *Pythium proliferum* de Bary; *Pythium proliferum* Schenk	Root rot	*Actinidea, Fragaria, Vitis*	No	No	No	Yes	No	No	No	7, 26
Pythium oligandrum Drechsler		Root rot	Wide host range	No	No	No	Yes	Yes	No	No	7, 82
Pythium paroecandrum Drechsler		Rot	Wide host range	No	No	No	Yes	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Pythium rostratum Butler	*Pythium diameson* Sideris			Yes	No	No	No	No	No	No	7, 26
Pythium spinosum Sawada,		Rot	Wide host range	No	No	No	Yes	Yes	No	No	7, 12, 26
Pythium splendens Hans Braun		Rot	Wide host range	No	No	No	Yes	Yes	No	No	7, 12, 26
Pythium torulosum Coker & Patt.		Rot	Wide host range	No	No	No	Yes	No	No	No	7, 26
Pythium ultimum Trow		Rot	Wide host range	No	No	No	Yes	Yes	No	No	7, 12, 26
Pythium vexans de Bary	*Pythium allantocladon* Sideris; *P. ascophallon* Sideris; *P. complectens* Hans Braun; *P. piperinum* Dastur	Damping off	Wide host range	No	No	No	Yes	Yes	No	No	7, 8, 26
Radulum aterrimum (Fr.) Fr.	*Eutypa aterrima* (Fr.) Nannf.; *Hydnum aterrimum* Fr.; *Phaeoradulum aterrimum* (Fr.) Sacc. & Syd.; *Xenotypa aterrima* (Fr.) Petr.			No	No	Yes	No	No	No	No	7, 26
Ramularia macrospora Fresen.		Fruit rot		No	Yes	No	No	No	No	No	7, 26
Rhizoctonia solani Kühn	*Moniliopsis solani* (Kühn) Moore; *Pellicularia solani* (Kühn) Exner; *Thanatephorus cucumeris* (Frank) Donk	Root rot	Wide host range	No	No	No	Yes	Yes	No	No	7, 12, 26
Rhizopus oryzae Went & Prins. Geerl.	*Rhizopus arrhizus* A. Fisch.	Rhizopus rot		No	Yes	No	No	No	No	No	7, 26, 30
Rhizopus stolonifer (Ehrenb.) Vuill.	*Mucor mucedo* L. Spreng.; *Rhizopus artocarpi* (Berk. & Broome) Boedijn; *Rhizopus nigricans* Ehrenb.	Fruit rot	Wide host range	No	Yes	No	No	Yes	No	No	7, 8, 12, 26, 27, 74

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Rosellinia aquila (Fr.) Ces. & De Not.	*Byssitheca aquila* (Fr.) Bonord.; *Byssosphaeria aquila* (Fr.) Stev.; *Hypoxylon aquilum* (Fr.) Bref.; *Sphaeria aquila* Fr.; *Sphaeria byssiseda* Berk.	Wood rot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Rosellinia necatrix Berl. ex Prill..	*Dematophora necatria* Hartig; *Hypoxylon necatrix* (Berl. ex Prill.) Martin; *Pleurographium necator* (R. Hartig) Goid.	White root rot	Wide host range	No	No	Yes	Yes	Yes	No	No	7, 8, 12, 26
Schizophyllum commune Fr.	*Agaricus alneus* Reichard; *Schizophyllum alneum* Schröt.; *Schizophyllum multifidum* (Batsch) Fr.; *Schizophyllum radiatum* (Sw.) Fr.	Trunk rot	Wide host range	No	No	Yes	No	Yes	No	No	7, 12, 26, 27
Schizothyrium perexiguum (Roberge ex Desm.) Höhn.	*Coccomyces minutissimus* (Auersw.) Gola; *Naevala minutissima* (Auersw.) Hein; *Naevala perexigua* (Roberge ex Desm.) Holm & Holm; *Phacidium perexiguum* Roberge ex Desm.	Fly speck of fruit		No	Yes	No	No	No	No	No	7, 26
Schizothyrium pomi (Mont. & Fr.) v. Arx	*Asterina gaultheriae* Curtis; *Epipeltis gaultheriae* (Curtis) Theiss.; *Leptothyrium pomi* (Mont. : Fr.) Sacc.,; *Microthyriella paludosa* Booth; *Microthyriella rubi* Petr.; *Schizothyrium gaultheriae* (Curtis) Hohn; *Zygophiala jamaicensis* Mason	Flyspeck	Wide host range	No	Yes	No	No	Yes	No	No	7, 12, 26, 27
Sclerophoma mali Syd. & Syd.,				No	No	Yes	No	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Sclerophora pallida (Pers.) Yao & Spooner	*Calicium cantherellum* sensu Smith; *Sclerophora coniophaea* (Norman) Mattsson & Middelb.; *Roesleria hypogaea* Thuem. & Pass. *Roesleria pallida* (Pers.) Sacc.	Root rot		No	No	No	Yes	No	No	No	7, 26
Sclerotinia sclerotiorum (Lib) de Bary	*Peziza sclerotiorum* Libert; *Sclerotinia libertiana* Fuckel; *Whetzelinia sclerotiorum* (Lib.) Korf & Dumont	Cottony soft rot, calex end rot	Wide host range	No	Yes	Yes	Yes	Yes	No	No	7, 8, 26
Scolicosporium pedicellatum Dearn. & Overh.				No	No	Yes	No	No	No	No	7, 26
Scytinostroma galactinum (Fr.) Donk	*Corticium galactinum* (Fr.) Burt; *Phanerochaete velutina var. alnea* (Fr.) Parmasto; *Scytinostroma eurasiaticogalactinum* Boidin & Lanq.; *Stereum suaveolens* (Fr.) Fr.; *Thelephora galactina* Fr.	White root rot	Wide host range	No	No	Yes	Yes	No	No	No	7, 26, 30
Septobasidium bogoriense Pat.		Felty fungus	*Camellia, Mango, Morus, Pyrus*	No	No	No	No	No	No	No	1, 7
Septobasidium pedicellatum (Schwein.) Pat.	*Thelephora pedicellata* Schwein.			No	No	No	No	No	No	No	7, 26
Septobasidium pseudopedicellatum Burt			Parasitic on scale insects	Yes	No	No	No	No	No	No	7, 26
Septobasidium tanakae (Miyabe) Boedijn & B.A. Steinm.	*Helicobasidium tanakae* Miyabe			No	No	No	No	No	No	Yes	1, 7

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Sphaeropsis mali (Westend.) Sacc.	*Aplosporella mali* (Westend.) Petr. & Syd.; *Diplodia mali* (Westend.) Lambotte; *Macroplodia mali* Westend.			No	No	Yes	No	No	No	No	7, 26
Sphaeropsis pomorum (Schwein.) Cooke	*Sphaeria pomorum* Schwein.			No	No	Yes	No	No	No	No	7, 26
Sphaeropsis pyriputrescens Xiao & Rogers		Fruit rot, canker, die back		No	Yes	Yes	No	No	No	Yes	7, 26, 83
Sphaerotheca fuliginea (Schltdl.) Pollacci	*Acrosporium erysiphoides* (Fr.) Subram.; *Euoidium erysiphoides* (Fr.) Paul & Kapoor; *Podosphaera ferruginea* (Schltdl.) Braun & Takam.; *Podosphaera fuliginea* (Schltdl.) Braun & Takam.; *Sphaerotheca ferruginea* (Schltdl.) Junell;	Powdery mildew	Wide host range	No	No	Yes	No	Yes	No	No	7, 12, 26
Sphaerotheca pannosa (Wallr.) Lév.	*Acrosporium leucoconium* (Desm.) Sumst.; *Erysiphe pannosa* (Wallr.) Fr.; *Oidium leucoconium* Desm.; *Podosphaera pannosa* (Wallr.) de Bary; *Sphaerotheca pannosa var. rosae* Woron.	Powdery mildew	*Rosa, Prunus*	No	No	Yes	No	Yes	No	No	7, 12, 26
Spongipellis spumeus (Sowerby) Pat.	*Boletus spumeus* Sowerby; *Inonotus victoriensis* (Lloyd) Pegler; *Pseudoinonotus victoriensis* (Lloyd) Wagner & Fisch.; *Polyporus spumeus* (Sowerby) Fr.; *Tyromyces spumeus* (Sowerby) Imazeki; *Tyromyces subgiganteus* (Berk. & Curtis) Ryvarden	Sapwood rot	Wide host range	No	No	Yes	No	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Sporidiobolus pararoseus Fell & Tallman	*Sporobolomyces shibatanus* (Okun.) Verona & Cif.; *Torula shibatana* Okun.		*Crataegus, Helianthus, Plantago*	Yes	No	No	No	No	No	No	7, 26
Stagonospora biformis Ellis & Barthol.				No	No	Yes	No	No	No	No	7, 26
Stagonospora prominula (Berk. & Curtis) Sacc.	*Hendersonia prominula* Berk. & Curtis			No	No	Yes	No	No	No	No	7, 26
Stemphylium congestum Newton		Fruit spot		No	Yes	No	No	No	No	No	7, 26
Stemphylium graminis (Corda) Bonord	*Fumago graminis* (Corda) Hughes; *Soredospora graminis* Corda			No	No	Yes	No	No	No	No	7, 26
Stereum complicatum (Fr.) Fr.	*Stereum complicatum sensu* Nordic Macromycetes; *Stereum hirsutum var. complicatum* (Fr.) Rick; *Thelephora complicata* Fr.			No	No	No	No	No	No	No	7, 26
Stereum erumpens Burt	*Dendrophora erumpens* (Burt) Chamuris; *Peniophora erumpens* (Burt) Boidin; *Stereum versiforme f. erumpens* (Burt) Killerm.		Wide host range	No	No	Yes	No	No	No	No	7, 26
Stereum gausapatum (Fr.) Fr.	*Haematostereum gausapatum* (Fr.) Pouzar; *Stereum quercinum* Potter; *Stereum spadiceum sensu auct.*; *Thelephora gausapata* Fr.;	White rot	*Quercus*	No	No	Yes	No	No	No	No	7, 26
Stereum hirsutum (Willd.) Pers.	*Stereum complicatum* (Fr.) Fr.; *Stereum reflexum* (Bull.) Sacc.; *Thelephora hirsuta* Willd.; *Thelephora reflexa* (Bull.) Lam. & DC.	Heart rot		No	No	Yes	No	Yes	No	No	7, 12, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Strasseria carpophila Bres. & Sacc. ex Strasser				No	No	Yes	No	No	No	No	7, 26
Taphrina bullata (Berk. & Broome) Tul.	*Ascomyces bullatus* Berk.; *Exoascus bullatus* (Berk. & Broome) Fuckel; *Oidium bullatum* Berk. & Broome			No	No	Yes	No	No	No	No	7, 26
Teichospora seminuda (Pers. & De Not.) Sacc.	*Sphaeria seminuda* De Not.			No	No	No	No	No	No	No	7, 26
Trametes pubescens (Schumach.) Pilat	*Bjerkandera pubescens* (Schumach.) Karst.; *Coriolus velutinus* (Pers.) Pat.; *Polyporus pubescens* (Schumach.) Fr.; *Trametes velutina* (Pers.) Cunn.;	White rot	Wide host range	No	No	Yes	No	No	No	Yes	1, 7, 26
Trametes versicolor (L. ex. Fr.) Pilat	*Boletus versicolor* L.; *Coriolus versicolor* (L.) Quel.; *Polyporus versicolor* (L. ex. Fr.) Quel.	Wood rot	*Pyrus*	No	No	Yes	No	Yes	No	No	7, 26
Trechispora farinacea (Pers.) Liberta	*Corticium submutabile* Höhn. & Litsch.; *Cristella farinacea* (Pers.) Donk; *Cristella submutabilis* (Höhn. & Litsch.) Donk; *Phlebiella farinacea* (Pers.) Bondartsev & Singer; *Trechispora submutabilis* (Höhn. & Litsch.) Parmasto		Wide host range	Yes	No	No	No	No	No	No	7, 26
Trichoderma viride Pers.	*Pyrenium lignorum* Tode; *Trichoderma lignorum* (Tode) Harz	Rot	Wide host range	No	No	No	No	Yes	No	No	7, 12, 26
Trichothecium roseum (Pers.) Link	*Cephalothecium roseum* Corda; *Hyphoderma roseum* (Pers.) Fr.; *Sphaeria rosea Pers.*; *Trichoderma roseum* Pers.	Pink rot		No	Yes	No	No	Yes	No	No	7, 26, 30

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Tripospermum myrti (Lind) Hughes	*Triposporium myrti* Lind		*Acer*	No	No	Yes	No	No	No	No	7, 26
Truncatella angustata (Pers.) Hughes	*Pestalotia angustata* (Pers.) Arx; *Sporidesmium angustatum* (Pers.) Corda; *Stilbospora angustata* Pers.			No	No	No	No	No	No	No	7, 26
Tympanis conspersa (Fr.) Fr.	*Sphaeria conspersa* Fr.			No	No	Yes	No	No	No	No	7, 26
Tyromyces chioneus (Fr.) Karst.	*Leptoporus albellus* (Peck) Bourdot & Maire; *Leptoporus lacteus f. albellus* (Peck) Pilát; *Polyporus albellus* Peck; *Tyromyces albellus* (Peck) Bondartsev & Singer	Sapwood rot	Wide host range	No	No	No	No	No	No	No	7, 26
Ulocladium consortiale (Thüm.) Simmons	*Alternaria consortialis* (Thüm.) Groves & Hughes; *Macrosporium consortiale* Thüm.; *Pseudostemphylium consortiale* (Thüm.) Subram.; *Stemphylium consortiale* (Thüm.) Groves & Skolko; *Stemphylium ilicis* Tengwall	Leaf spot	Wide host range	No	No	Yes	No	No	No	No	7, 26
Valsa ceratosperma (Tode ex Fr.) Maire	*Cytospora capreae* Fuckel; *Cytospora fuckelii* Sacc.; *Cytospora mali* Grove; *Valsa americana* Berk. & Curtis *Valsa fuckelii* Nitschke; *Valsa mali* Miyabe & Yamada; *Valsa mulleriana* Cooke	Valsa canker	*Pyrus, Cydonia*	No	No	Yes	No	No	No	Yes	7, 26, 83
Valsa malicola Urban	*Cytospora schulzeri* Sacc. & Syd.			Yes	No	No	No	No	No	No	7, 26
Valsa papyriferae Cooke	*Valsella papyriferae* (Schwein.) Berl. & Voglino			No	No	No	No	No	No	No	7, 26

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Valsella melastoma (Fr.) Sacc.	*Fenestella melastoma* (Fr.) Sacc.; *Sphaeria melastoma* Fr.; *Valsa melastoma* Fr.			No	No	Yes	No	No	No	No	7, 26
Venturia asperata Samuels & Sivan.				Yes	No	No	No	No	No	No	7, 76
Venturia inaequalis (Cooke) Winter	*Cladosporium dendriticum* Wallr.; *Fusicladium dentriticum* (Wallr.) Fuckel; *Fusicladium pomi* (Fr.) Lind.; *Sphaerella inaequalis* Cooke; *Spilocaea pomi* Fr.; *Spilosticta inaequalis* (Cooke) Petr. *Sphaeria cinerascens* Fuckel	Scab	*Pyrus, Sorbus, Pyracantha, Cotoneaster, Crataegus, Viburnum*	No	Yes	Yes	No	Yes	No	No	7, 8, 12, 26, 71, 74
Venturia pyrina Aderh.	*Endostigme pyrina* (Aderh.) Syd.; *Fusicladium pyrorum* (Lib.) Fuckel; *Helminthosporium pyrorum* Lib.; *Megacladosporium pyrinum* (Lib.) Vienn.-Bourg.	Pear scab	*Pyrus* Rare on apples	No	Yes	Yes	No	Yes	No	No	7, 12, 26, 30
Verticillium dahliae Kleb.	*Verticillium ovatum* Berkeley & Jackson		Wide host range	No	No	Yes	Yes	Yes	No	No	7, 26
Xylaria curta Fr.	*Xylaria rhopaloides* Mont. *Xylosphaeria curta* (Fr.) Dennis		Wide host range	No	No	Yes	No	No	No	No	7, 26
Xylaria longiana Rehm		Root rot	*Prunus, Quercus*	No	No	Yes	Yes	No	No	No	7, 26
Xylaria mali Fromme		Black root rot	*Acer, Prunus, Pyrus*	No	No	No	Yes	No	No	Yes	1, 7, 26, 30

Scientific Name	Synonym/Other stages	Common Name	Other hosts	Saprophyte	Fruit	Vegetative propagation material	Roots	Present in SA	Current quarantine status - A1	Eligible for further consideration by SA NPPO	References*
Xylaria polymorpha (Pers.) Grev.	*Coelorhopalon obovatum* (Berk.) Overeem; *Sphaeria obovata* Berk.; *Xylaria corrugata* Har. & Pat.; *Xylaria rugosa* Sacc.; *Xylosphaera obovata* (Berk.) Dennis	White rot	*Acer, Cercis*	No	No	Yes	Yes	No	No	No	8, 7, 26, 30
Xylochora nigropunctata (Romell) Arx & Müll.	*Physalospora nigropunctata* Romell			No	No	Yes	No	No	No	No	7, 26

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Table 2. List of fungal pathogens reported on *Vitis* spp.

Scientific name	Synonyms/ Other stages	Common name	Other host plants	Sapro-phyte	Fruit	Veg. propa-gation material	Roots	Present in SA	Current quarantine status- A1	Eligible for furter consideration by SA-NPPO	References*
Acremonium alternatum Link				No	No	Yes	No	No	No	No	1, 6
Aleurobotrys botryosus (Burt) Boidin, Lanq. & Gilles	*Aleurodiscus botryosus* Burt		Wide host range	No	No	Yes	No	No	No	No	1, 5
Alternaria alternata (Fr.) Keissl.	*Alternaria fasciculata* (Cooke & Ellis) Jones & Grout; *Alternaria rugosa* McAlpine; *Alternaria tenuis* Nees; *Macrosporium fasciculatum* Cooke & Ellis; *Torula alternata* Fr.	Fruit rot; leaf spot	Wide host range	No	Yes	Yes	No	Yes	No	No	1, 3, 5, 6
Alternaria gomphrenae Togashi	*Nimbya gomphrenae* (Togashi) Simmons	Leaf spot		No	No	Yes	No	No	No	No	1, 5
Alternaria tenuissima (Kunze) Wiltshire	*Clasterosporium tenuissimum* (Nees & T. Nees) Sacc.; *Helminthosporium tenuissimum* Kunze; *Macrosporium tenuissimum* (Kunze) Fr.	Grape rot		No	Yes	No	No	No	No	No	1, 6
Alternaria viticola Brunaud		Leaf spot		No	No	Yes	No	No	No	No	1, 6, 13
Alternaria vitis Cavara	*Macrosporium vitis* Sorokīn	Leaf spot		No	No	Yes	No	Yes	No	No	1, 3, 6
Amerosporium concinnum Petr.	*Amerosporina concinna* (Petr.) Petr.			No	No	No	No	No	No	No	1, 6
Amphisphaeria sylvana Sacc. & Speg.				No	No	No	No	No	No	No	1, 6

Scientific name	Synonyms/ Other stages	Common name	Other host plants	Sapro-phyte	Fruit	Veg. propa-gation material	Roots	Present in SA	Current quarantine status- A1	Eligible for furter consideration by SA-NPPO	References*
Anthostomella pullulans (de Bary) Bennett		Brulure		No	No	Yes	No	No	No	No	1, 6
Apiospora montagnei Sacc.	*Arthrinium arundinis* (Corda) Dyko & Sutton; *Coniosporium arundinis* (Corda) Sacc.; *Gymnosporium arundinis* Corda; *Sphaeria montagnei* (Sacc.) Buckn.; *Tubercularia apiospora* Durieu & Mont		Wide host range	Yes	No	No	No	No	No	No	1, 5, 6
Aplosporella fabaeformis (Pass. & Thüm.) Petr. & Syd.	*Diplodia fabaeformis* Pass. & Thüm.			No	No	Yes	No	No	No	No	1, 5, 6
Armillaria limonea (Stev.) Boesew.	*Armillariella limonea* Stev.			No	No	No	Yes	No	No	Yes	1, 6
Armillaria luteobubalina Watling & Kile		Armillaria root rot	Wide host range	No	No	No	Yes	No	No	Yes	1. 6
Armillaria mellea (Vahl) Kumm.	*Agaricus melleus* Vahl:Fr.; *Armillariella mellea* (Vahl) Karst.; *Clitocybe mellea* (Vahl) Ricken; *Rhizomorpha subcorticalis* Pers	Armillaria root rot	Wide host range	No	No	No	Yes	Yes	No	No	1, 5, 6, 13
Armillaria novae-zelandiae (Stev.) Boesew.	*Armillaria novae-zelandiae* (Stev.) Herink; *Armillariella novae-zelandiae* Stev.	Armillaria root rot		No	No	No	Yes	No	No	Yes	1, 6

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Armillaria tabescens (Scop.) Emel	*Agaricus tabescens* Scop; *Armillariella tabescens* (Scop.) Singer; *Clitocybe monadelpha* (Morg.) Sacc.; *Clitocybe tabescens* (Scop.) Bres.; *Clitocybe parasitica* Wilcox	Armillaria root rot	Wide host range	No	No	No	Yes	No	No	No	1, 5, 6
Ascochyta ampelina Sacc.	*Ascochytella ampelina* (Sacc.) Petr.; *Pseudodiplodia ampelina* (Sacc.) Petr.	Leaf spot, leaf rot		No	No	Yes	No	No	No	No	1, 5,6
Ascospora viticola Nasyrov				No	No	Yes	No	No	No	No	1, 6
Aspergillus aculeatus Iizuka		Berry rot, bunch rot	Wide host range	No	Yes	No	No	No	No	No	1, 13
Aspergillus carbonarius (Bainier) Thom	*Sterigmatocystis carbonaria* Bainier	Storage rot	*Zea*	No	Yes	No	No	Yes	No	No	1, 3, 5, 6
Aspergillus flavus Link.	*Aspergillus parasiticus* Spear	Fruit rot	Wide host range	No	Yes	No	No	No	No	No	1, 6, 13
Aspergillus niger Tiegh	*Aspergillopsis nigra* (Tiegh.) Speg.; *Rhopalocystis nigra* (Tiegh.) Grove; *Sterigmatocystis nigra* (Tiegh.) Sacc.	Fruit rot	Wide host range	No	Yes	No	No	Yes	No	No	1, 3, 5, 6,

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Aspergillus wentii Wehmer		Fruit rot	Wide host range	No	Yes	No	No	No	No	No	1, 13
Asperisporium minutulum (Sacc.) Deighton	*Fusicladium minutulum* Sacc.	Leaf spot		No	No	Yes	No	No	No	Yes	1, 5, 6, 13
Asperisporium vitiphyllum (Speschnew) Deighton	*Cercospora vitiphylla* (Speschnew) Barbarin; *Coryneum vitiphyllum* Speschnew; *Exosporium sultanae* du Plessis; *Stigmina esfandiari* Petrak; *Scolicotrichum vitiphyllum* (Speschnew) Karak. & Vassiljevsky	Leaf spot		No	No	Yes	No	Yes	No	No	1, 3, 6
Athelia rolfsii (Curzi) Tu & Kimbr.	*Corticium centrifugum* (Lév.) Bres.; *Fibulorhizoctonia centrifuga* (Lév.) Adams & Kropp; *Pellicularia rolfsii* (Curzi) West; *Sclerotium rolfsii* Sacc.	Collar rot	Wide host range	No	No	No	Yes	Yes	No	No	1, 5, 6
Aureobasidium pullulans (de Bary) Arnaud	*Aureobasidium pullulans var. pullulans* (de Bary) Arnaud; *Aureobasidium vitis* Viala & Boyer; *Exobasidium vitis* (Viala & Boyer) Prill. & Delacr.			Yes	No	No	No	Yes	No	No	1, 3, 5, 6
Bactrodesmium pallidum Ellis				No	No	No	No	No	No	No	1, 6

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Bartalinia robillardoides Tassi	*Seimatosporium robillardoides* (Tassi) Arx			No	No	Yes	No	No	No	No	1, 6
Berkleasmium corticola (Karst.) Moore	*Sporidesmium moriforme* subsp. *corticola* Karst.		*Abies*	No	No	Yes	No	No	No	No	1, 5
Bertia vitis Schulz				No	No	No	No	No	No	No	1,6
Bipolaris papendorfii (Aa) Alcorn	*Drechslera papendorfii* (Aa) Ellis	Leaf spot	Wide host range	No	No	Yes	No	No	No	No	1
Biscogniauxia capnodes (Berk.) Ju & Rogers	*Sphaeria capnodes* Berk.			No	No	Yes	No	No	No	No	1, 6
Botryodiplodia theobromae (Cooke) Petr. & Syd.	*Macrophoma palmorum* (Cooke) Berl. & Voglino; *Phoma palmorum* Sacc.			No	No	No	No	No	No	No	1, 6
Botryodiplodia palmarum (Cooke) Pet. &Syd.	*Sphaeropsis palmorum* Cooke; *Phoma palmorum* Sacc.	Leaf spot		No	No	Yes	No	No	No	No	1, 5, 6
Botryodiplodia vitis Sousa da Câmara				No	No	Yes	No	No	No	No	1, 6
Botryosphaeria australis Slippers, Crous & Wingf.		Die back, bunch rot		No	No	Yes	No	Yes	No	No	18
Botryosphaeria dothidea (Moug) Ces & de Not.	*Fusicoccum aesculi* Sacc.; *Camarosporium flaccidum* (Viala & Rovaz.) & Trav.-Klon; *Macrophoma flaccida* (Viala & Ravaz) Cavara; *Phoma flaccida* Viala & Ravaz.	False black rot, Excoriosis	Wide host range	No	No	Yes	No	No	No	No	13, 18

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Botryosphaeria lutea Phillips		Die back, bunch rot		No	No	Yes	No	Yes	No	No	18
Botryosphaeria obtusa (Schwein) Shoemaker	*Diplodia malorum* Fuckel; *Sphaeropsis malorum* Peck	Die back	Wide host range	No	No	Yes	No	Yes	No	No	13, 18
Botryosphaeria parva Pennycook & Samuels		Die back	Wide host range	No	No	Yes	No	Yes	No	No	18
Botryosphaeria rhodina (Berk. & Curtis) Arx	*Botryodiplodia theobromae* Pat.; *Diplodia theobromae* (Pat.) Nowell; *Diplodia natalensis* Pole Evans; *Diplodia viticola* Desm.; *Lasiodiplodia theobromae* (Pat.) Griffen & Maubl.;	Cane die back, bunch rot	Wide host range	No	No	Yes	No	Yes	No	No	13, 18
Botryosphaeria ribis Grossenb. & Dugger		Die back		No	No	Yes	No	No	No	No	18
Botryosphaeria stevensii Shoemaker	*Diplodia mutila* (Fr.) Mont.; *Sphaeropsis malorum* Oeck	Black dead arm	Wide host range	No	No	Yes	No	No	No	No	13, 18
Botryosphaeria vitis (Schulzer) Sacc.		Die back		No	No	Yes	No	No	No	Yes	18
Botryotinia fuckeliana (de Bary) Whetzel	*Botrytis cinerea* Pers. Fr.; *Sclerotinia fuckeliana* (de Bary) Fuckel	Gray mold, Botrytis bunch rot, Botrytis blight	Wide host range	No	Yes	Yes	No	Yes	No	No	1, 3, 5, 6, 13

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Briosia ampelophaga Cavara		Brown zonate spot, leaf blotch		No	No	Yes	No	No	No	Yes	1, 5, 6, 13
Calonectria kyotensis Terash.	*Calonectria morganii* Crous, Alfenas & Wingf.			No	No	Yes	No	No	No	No	1, 6
Camarosporium viniferum Ahmad				No	No	Yes	No	No	No	No	1, 6
Campylocarpon fasiculare Schroers, Halleen & Crous		Black foot disease		No	No	Yes	Yes	Yes	No	No	8
Campylocarpon pseudofasciculare Schroers, Halleen & Crous		Black foot disease		No	No	No	Yes	Yes	No	No	8
Capnodium salicinum Mont.	*Polychaeton salicinum* (Mt.) Kuntze; *Fumagospora capnodioides* Arnaud; *Pleosphaeria salicina* (Mont.) Arnaud		*Acer; Populus; Salix*	No	No	No	No	No	No	No	1, 6
Cephaleuros virescens Kunze		Brown rust, red rust		No	No	Yes	No	No	No	No	1
Cercospora coryneoides Săvul. & Rayss				No	No	Yes	No	No	No	No	1, 6
Cercospora fuckelii (Thüm.) Jacz.	*Septosporium fuckelii* Thüm.			No	No	Yes	No	No	No	No	1, 6
Cercospora judaica Rayss				No	No	Yes	No	No	No	No	1, 6

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Cercospora truncata Ellis & Everh.			*Ampelopsis*	No	No	Yes	No	No	No	No	5, 6
Chaetospermum chaetosporum (Pat.) Sm. & Ramsb.	*Tubercularia chaetospora* Pat.			No	No	Yes	No	No	No	No	1, 6
Chalara ampullula (Sacc.) Sacc., Michelia	*Sporoschisma ampullula* Sacc.			No	No	Yes	No	No	No	No	1, 6
Chalara elegans Nag Raj & Kendrik	*Thielaviopsis basicola* (Berk. & broome) Ferraris; *Trichocladium basicola* (Berk & Bromme) Carmichael	Fruit rot, black root rot, basal stem rot	Wide host range	No	No	Yes	No	No	No	Yes	1, 5
Chondrostereum purpureum (Pers.) Pouzar	*Stereum purpureum Pers.*; *Stereum rugosiusculum* Berk. & Curtis		Wide host range	Yes	No	Yes	No	No	No	No	1, 5
Cicinobolus cesatii de Bary	*Ampelomyces quisqualis* Ces.			No	No	Yes	No	No	No	No	1, 4, 6, 7
Cladosporium baccae Verwoerd & Dippen.		Cladosporium rot		No	Yes	No	No	Yes	No	No	3
Cladosporium cladosporioides (Fresen) De Vries		Fruit rot, brown rot, Cladosporium leaf spot	Wide host range	No	Yes	No	No	No	No	No	1, 5
Cladosporium longipes Sorokīn				No	No	No	No	No	No	No	1, 6
Cladosporium macrocarpum Preuss	*Cladosporium herbarum* var. *macrocarpum* (Preuss) Ho & Dugan			Yes	No	No	No	No	No	No	1, 6
Cladosporium oxysporum Berk. & Curtis			*Alnus; Citrus; Helianthus*	No	No	No	No	No	No	No	1, 6

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Cladosporium tenuissimum Cooke			*Zea*	No	No	Yes	No	No	No	No	1, 6
Cladosporium uvarum McAlpine				No	No	No	No	No	No	No	1, 6
Clathrospora turkestanica Domashova				No	No	Yes	No	No	No	No	1, 6
Claudopus proteus Kalchbr.				No	No	No	No	Yes	No	No	4, 7
Cochliobolus bicolor Paul & Parberry	*Bipolaris bicolor* (Mitra) Shoemaker; *Dreschlera bicolor* (Mitra) Subram. & Jain; *Helminthosporium bicolor* Mitra	Leaf spot	Wide host range	No	No	Yes	No	No	No	No	1
Cochliobolus geniculatus Nelson				No	No	Yes	No	No	No	No	1, 6
Colletotrichum acutatum Simmonds	*Glomerella acutata* Guerber & Correll		Fruit rot	No	Yes	No	No	No	No	No	1, 6
Colletotrichum ampelinum Cavara				No	No	Yes	No	No	No	No	1, 6
Colletotrichum crassipes (Speg.) Arx	*Gloeosporium crassipes* Speg.		*Agave*	No	Yes	Yes	No	No	No	No	5, 6
Colletotrichum gloeosporioides (Penz.) Penz. & Sacc.	*Gloeosporium rufomaculans* (Berk.) Thüm; *Glomerella cingulata* (Stonem.) Spauld. Schrenk	White rot, ripe rot	Wide host range	No	Yes	No	No	Yes	No	No	1, 3, 5, 6, 13

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Corticium appalachiense (Burds. & Larsen) Larsen	*Laeticorticium appalachiense* Burds. & Larsen			No	No	Yes	No	No	No	No	1, 5
Coryneopsis microsticta Grove				No	No	Yes	No	No	No	No	1, 6
Crepidotus amarus Murrill				No	No	Yes	No	No	No	No	1, 5
Cristulariella moricola (Hino) Redhead	*Cristuriella pyramidalis* Waterman & Marshall; *Grovesinia pyramidalis* Cline, Crane & Cline	Leaf spot, Target spot	Wide host range	No	No	Yes	No	No	No	Yes	5, 6, 13
Cryptophaeella trematosphaeriicola Frolov				No	No	No	No	No	No	No	1, 6
Cryptostictis ampelophila (Speg.) Guba	*Monochaetinula ampelophila* (Speg.) Nag Raj; *Monochaetia ampelophila* Speg.			No	No	Yes	No	No	No	No	1, 6
Cryptostictis hysterioides Fuckel	*Seimatosporium hysterioides* (Fuckel) Brockmann			No	No	Yes	No	No	No	No	1, 6
Cryptostictis inaequalis Tehon & Stout				No	No	Yes	No	No	No	No	5, 6
Cryptovalsa ampelina Nitschke				No	No	Yes	No	No	No	No	1, 5, 6
Coniochaeta pulveracea (Ehrh.) Munk	*Rosellinia pulveracea* (Ehrh.) Fuckel		Wide host range	No	No	Yes	No	No	No	No	1, 5

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Coniothyrium ampelinum Cooke				No	No	Yes	No	No	No	No	5, 6
Coniothyrium berlandieri Viala & Sauv.		Leaf spot		No	No	Yes	No	No	No	No	5, 6
Coniothyrium iranicum Esfand.				No	No	Yes	No	No	No	No	1, 6
Cylindrocarpon obtusisporum (Cooke & Harkn.) Wollenweb.	*Fusarium obtusisporum* Cooke & Harkn.	Black foot	Wide host range	No	No	Yes	No	Yes	No	No	8
Cylindrocladiella lageniformis Crous, Wingf. & Alfenas		Rot		No	No	No	Yes	Yes	No	No	16
Cylindrocladiella parva (Anderson) Boesew.		Root rot	*Eucalyptus, Fragaria, Persea american, Pinus, Prunus*	No	No	No	Yes	Yes	No	No	16
Cylindrocladiella peruviana (Bat., Bezerra & Herrera) Boesew.		Rot	*Eucalyptus, Protea*	No	No	Yes	Yes	Yes	No	No	16
Cylindrocladiella viticola Crous & Van Coller		Rot		No	No	Yes	No	Yes	No	No	16
Cyphella monacha Speg.	*Cyphellopsis monacha* (Speg.) Reid; *Maireina monacha* (Speg.) Cooke			No	No	No	No	No	No	No	1, 6

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Cytospora vitis Mont.	*Eutypella aequilinearis* (Schwein.) Starb.			No	No	Yes	No	No	No	No	5, 6
Dendrophora erumpens (Burt) Chamuris	*Peniophora erumpens* (Burt) Boidin; *Stereum erumpens* Burt		Wide host range	No	No	Yes	No	No	No	No	1, 5
Diaporthe australafricana Crous & Van Niekerk		Cane and leaf spot		No	No	Yes	No	Yes	No	No	19
Diaporthe helianthi Munt.-Cvetk., Mihaljč. & Petrov			*Helianthus*	No	No	Yes	No	Yes	No	No	19
Diaporthe perjuncta Niessl	*Diaporthe conjuncta* Niessl; *Diaporthe saccardiana* Kunze ex Sacc.	Phomopsis cane and leaf spot		No	No	Yes	No	No	No	No	11, 19
Diaporthe rudis (Fr.) Nitschke	*Diaporthe faginea* (Curr.) Sacc.; *Valsa faginea* Curr.			No	No	Yes	No	No	No	No	1, 5
Diaporthe viticola Nitschke		Cane and leaf spot		No	No	Yes	No	No	No	No	19
Diatrype stigma (Hnom.) Fr.	*Diatrype stigmoides* Kauffm.		Wide host range	No	No	Yes	No	No	No	No	1, 5, 6
Dichomera viticola Cooke & Harkn.	*Camarosporium viticola* (Cooke & Harkn.) Sacc.			No	No	Yes	No	No	No	No	5, 6
Dictyosporium toruloides (Corda) Guég.	*Speira toruloides* Corda			No	No	Yes	No	No	No	No	1, 6

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Didymosphaeria sarmenti (Cooke & Hark.) Berl. & Voglino	*Sphaeria sarmenti* Cooke & Harkn.	Gummosis		No	No	Yes	No	No	No	Yes	1, 5, 6
Diplodia ampelina Cooke				No	No	Yes	No	No	No	No	5, 6
Diplodia porosum Niekerk & Crous				No	No	Yes	No	Yes	No	No	18
Diplodina vitis Brunaud				No	No	Yes	No	No	No	No	1, 6
Discosia artocreas (Tode) Fr.	*Sphaeria artocreas Tode, Fung.*		Wide host range	No	No	Yes	No	No	No	No	5, 6
Discosia vitis Schulzer				No	No	Yes	No	No	No	No	1, 6
Discostroma corticola (Fuckel) Brockmann	*Metasphaeria corticola* (Fuckel) Sacc.; *Seimatosporium lichenicola* (Corda) Shoemaker & Müll.		Wide host range	No	No	Yes	No	No	No	No	1, 5, 6
Doratomyces stemonitis (Pers.) Morton & Sm.	*Cephalotrichum stemonitis* (Pers.) Nees			Yes	No	No	No	No	No	No	1, 5, 6
Drechslera tetramera (McKinney) Subram. & Jain	*Helminthosporium tetramera* McKinney	Leaf spot		No	No	No	No	No	No	No	1

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Elsinoe ampelina (de Bary) Shear	*Gloeosporium ampelophagum* (Pass.) Sacc.; *Sphaeceloma ampelinum* de Bary	Anthracnose, bird's eye rot		No	Yes	Yes	No	Yes	No	No	1, 3, 5, 6, 13
Endobasidium clandestinum Speschnew				No	No	No	No	No	No	No	1, 6
Epicoccum nigrum Link	*Epicoccum purpurascens* Ehrenb.; *Epicoccum vulgare* Corda; *Phoma epicoccina* Punith., Tulloch & Leach		Wide host range	No	Yes	No	No	No	No	No	5, 6
Eriocercosporella vitis-heterophyllae (Henn.) Braun		Leaf spot		No	No	Yes	No	No	No	No	1, 6
Eriosphaeria oenotria Sacc. & Speg.				No	No	Yes	No	No	No	No	1, 6
Erysiphe necator Schwein.	*Oidium tuckeri* Berk.; *Uncinula americana* Hawe; *Uncinula necator* (Schwein.) Burrill;	Powdery mildw	*Ampelopsis, Cissus,*	No	No	Yes	No	Yes	No	No	1, 3, 5, 6, 13
Eutypa lata (Pers.:Fr.) Tul. & Tul.	*Cytosporina lata* Höhn.; *Eutypa armeniacae* Hansf. & Carter; *Libertella blepharis* Smith	Eutypa die back, dead arm, dying arm	Wide host range	No	No	Yes	No	Yes	No	No	1, 3, 5, 6, 13

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Eutypella vitis (Schwein.) Ellis & Everh.	*Sphaeria vitis* Schwein.; *Valsa vitis* (Schwein.) Fuckel			No	No	Yes	No	No	No	No	1, 6
Fomes fomentarius (L.) Kickx	*Pyropolyporus fomentarius* (L.) Teng			No	No	Yes	No	No	No	No	1, 6
Fomitiporia punctata (Fr.) Murrill	*Phellinus punctatus* (Fr.Ex Karst.) Pilat	Esca disease complex	Wide host range	No	No	Yes	No	No	No	No	9
Fusarium avenaceum (Fr.) Sacc.	*Gibberella avenacea* Cook; *Fusisporium avenaceum* Fr.	Root rot	Wide host range	No	No	No	Yes	No	No	No	1, 6
Fusarium chlamydosporum Wollenw. & Reinking		Root and crown rot	*Carya*	No	No	No	Yes	Yes	No	No	17
Fusarium equiseti (Corda) Sacc.			Wide host range	No	No	No	Yes	Yes	No	No	1, 5, 6, 17
Fusarium nygamai Burgess & Trimboli				No	No	No	Yes	Yes	No	No	1, 17
Fusarium oxysporium Schltdl.		Root rot	Wide host range	No	No	No	Yes	Yes	No	No	1, 6, 17
Fusarium poae (Peck) Wollenw.	*Sporotrichum poae* Peck	Rot	Wide host range	No	No	No	Yes	No	No	No	5, 6
Fusarium proliferatum (Matsushima) Nirenberg			Wide host range	No	No	No	Yes	Yes	No	No	17
Fusarium scirpi Lamb. & Fautrey	*Gibberella acuminata* Booth			No	No	No	Yes	Yes	No	No	17

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Fusarium semitectum Berk. & Ravenel		Root rot		No	No	No	Yes	Yes	No	No	17
Fusarium solani (Mart.) Sacc.		Root rot	Wide host range	No	No	No	Yes	Yes	No	No	1, 6, 17
Fusicladium viticis Ellis				No	No	Yes	No	No	No	No	1, 6
Fusicoccum luteum Pennycook & Samuels				No	No	Yes	No	No	No	No	1, 6
Fusicoccum viticlavatum Niekerk & Crous				No	No	Yes	No	Yes	No	No	18
Fusicoccum vitifusiforme Niekerk & Crous				No	No	Yes	No	Yes	No	No	18
Gibberella fujikuori (Sawada) Wollenweb.	*Fusarium moniliforme* Sheld;	Fruit rot	Wide host range	No	No	No	No	No	No	No	13
Gibberella intricans Wollenw.		Rot		No	No	Yes	Yes	No	No	No	5, 6
Gloeodes pomigena (Schwein.) Colby			Wide host range	No	Yes	Yes	No	No	No	No	5, 6
Grandinia pruni (Lasch) Jülich	*Hyphodontia pruni* (Lasch) Svrček; *Odontia pruni* Lasch; *Phanerochaete pruni* (Lasch) Rattan		Wide host range	No	No	Yes	No	No	No	No	1, 5
Graphium cinerellum Speg.				No	No	No	No	No	No	No	1, 6

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Greeneria uvicola (Berk. & Curtis) Punithalingam	*Greeneria fuligenea* Scriber & Viala; *Melanconium fuligeneum* (Scribner & Viala) Cav.; *Phoma uvicola* Berk. & Curtis	Bitter rot	*Malus*	No	Yes	Yes	No	Yes	No	No	3, 5, 6
Guignardia bidwelli (Ellis) Viala & Ravaz	*Laestadia bidwellii* (Ellis) Viala & Ravaz; *Phyllosticta amplicida* (Engelm.) van der Aa; *Phyllosticta ampelopsidis* Ellis & Martin *Phyllosticta viticola* Thum	Black rot		No	Yes	Yes	No	No	Yes	No	1, 5, 6,13
Hapalopilus rutilans (Pers.) Karst.	*Inonotus rutilans* (Pers.) Karst.; *Polyporus rutilans* (Pers.) Fr.		Wide host range	No	No	Yes	No	No	No	No	1, 5
Helminthosporium siliquosum Berk. & Curtis				No	No	Yes	No	No	No	No	5, 6
Helotium sarmentorum De Not.				No	No	No	No	No	No	No	1, 6
Hendersonia cookeana Speg.	*Camarosporium cookeanum* (Speg.) Sacc.			No	No	Yes	No	No	No	No	1,6
Hendersonia sarmentorum Westend.			*Rhododendron*	No	No	Yes	No	No	No	No	5, 6
Hendersonia viticola Ahmad				No	No	Yes	No	No	No	No	1, 6
Hypoderma commune (Fr.) Duby	*Leptothyrium vulgare* (Fr.) Sacc.		Wide host range	No	No	Yes	No	No	No	No	1, 6

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Hyporea ceramica Ellis& Everh.	*Trichoderma koningii* Oudem.		Wide host range	No	No	No	No	No	No	No	1, 5, 6
Irpex lacteus (Fr.) Fr.	*Polyporus tulipiferae* (Schwein.) Overh.; *Steccherinum lacteum* (Fr.) Krieglst.		Wide host range	No	No	Yes	No	No	No	No	1, 5
Kuehneola vitis (Butler) Syd. & Syd.	*Chrysomyxa vitis* Butler			No	No	Yes	No	No	No	No	1, 6
Lachnella macrochaeta Speg.	*Trichopezizella macrochaeta* (Speg.) Gamundí			No	No	Yes	No	No	No	No	1, 6
Lachnella myceliosa Cooke				No	No	Yes	No	No	No	No	1, 6
Lachnella uvicola (Speg.) Cooke	*Cyphella uvicola* Speg.			No	No	Yes	No	No	No	No	1, 6
Lachnella viticola Gonz. Frag.				No	No	Yes	No	No	No	No	1, 6
Leptosphaeria ampelina Curzi & Barbaini				No	No	Yes	No	No	No	No	1, 6
Leptosphaeria cerlettii Speg.				No	No	Yes	No	No	No	No	1, 6
Leptosphaeria chaetostoma Sacc.				No	No	Yes	No	No	No	No	1,6
Leptosphaeria cirricola Pass.				No	No	Yes	No	No	No	No	1, 6
Leptosphaeria gibelliana Pirotta				No	No	Yes	No	No	No	No	1, 6

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Leptosphaeria ogilviensis (Berk. & Broome) Ces. & De Not.	*Sphaeria ogilviensis* Berk. & Broome			No	No	Yes	No	No	No	No	1, 6
Leptosphaeria pampini (Thüm.) Sacc.	*Sphaeria pampini* Thüm.			No	No	Yes	No	No	No	No	1, 6
Leptosphaeria socia Sacc.				No	No	Yes	No	No	No	No	1, 6
Leptosphaeria vinealis Pass				No	No	Yes	No	No	No	No	1, 6
Leptosphaeria viticola Fautrey & Roum.				No	No	Yes	No	No	No	No	1, 6
Leptosphaeria vitigena (Schulzer) Sacc.	*Sphaerella vitigena* Schulzer			No	No	Yes	No	No	No	No	1, 6
Leptosphaeria vitis (Castagne) Pirotta	*Sphaeria vitis* Castagne			No	No	Yes	No	No	No	No	1, 6
Leptothyrium passerinii Thüm.				No	No	Yes	No	No	No	No	1, 6
Lophiostoma elegans (Fabre) Sacc.				No	No	No	No	No	No	No	1, 6
Lophiostoma thuemenianum Speg.				No	No	No	No	No	No	No	1, 6
Macrophoma farlowiana (Viala & Sauv.) Tassi	*Phoma farlowiana* Viala & Sauv.			No	No	Yes	No	No	No	No	5, 6

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Macrophoma longispora (Thüm. & Pass.) Berl. & Voglino	*Leptothyrium longisporum* Thüm.; *Phoma longispora* (Thüm.) Cooke			No	No	Yes	No	No	No	No	5, 6
Macrophoma reniformis (Viala & Ravaz) Cavara	*Dothiorella reniformis* (Viala & Ravaz) Petr. & Syd.; *Phoma reniformis* Viala & Ravaz			No	No	Yes	No	No	No	No	5, 6,
Macrophoma rimiseda (Sacc.) Berl. & Voglino	*Phoma rimiseda* Sacc.			No	No	Yes	No	No	No	No	1, 6
Macrophoma sicula Scalia				No	No	No	No	No	No	No	1, 6
Macrophomina phaseolina (Tassi)	*Macrophoma phaseoli* Maubl.	Root rot	Wide host range	No	No	No	Yes	Yes	No	No	1, 3, 5, 6
MarssOnina viticola (Miyake) Tai				No	No	Yes	No	No	No	No	1, 6
Massariella viticola Frolov				No	No	No	No	No	No	No	1, 6
Metschnikowia pulcherrima Pitt & Mill		Autumn leaf spot		No	No	Yes	No	No	No	Yes	1, 5
Micropera ampelina Sacc. & Fairm.				No	No	Yes	No	No	No	No	1, 6
Microthyrium microscopicum Desm.				Yes	No	No	No	No	No	No	1, 6
Mollisia cinerea (Batsch) Karst.	*Peziza cinerea* Batsch		Wide host range	Yes	No	No	No	No	No	No	1, 5

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Mucor circinelloides Tiegh.		Fruit rot	Wide host range	No	Yes	No	No	No	No	No	13
Mycosphaerella angulata Jenkins	*Cercospora brachypus* Ellis & Everh.; *Pseudocercospora brachypus* (Ellis & Everh.) Liu & Guo	Angular leaf spot		No	No	Yes	No	No	No	No	1, 5, 6, 13
Mycosphaerella personata Higgins	*Cercospora vitis* (Lev) Sacc.; *Cercospora viticola* (Ces.) Sacc.; *Cladosporium viticola* Ces.; *Cladosporium vitis* (Lev.); *Isariopsis clavispora* (Ber. & Curtis) Sacc; *Phaeoisariopsis vitis* (Lev.) Speg.; *Pseudocercospora vitis* (Lev.) Speg.	Leaf spot, leaf blight, Isariopsis blight	*Ampelopsis, Cissus, Ziziphus*	No	No	Yes	No	Yes	No	No	1, 3, 5, 6, 13
Mycosphaerella tassiana (De Not.) Johanson	*Cladosporium herbarum* (Pers.:Fr.) Link	Cladosporium rot, brown spot	Wide host range	No	Yes	Yes	No	No	No	No	5, 6, 13
Mycosphaerella vitis (Fuckel) Schröt.				No	No	Yes	No	No	No	No	1, 6
Mycovellosiella vitis Guo & Liu	*Passalora vitis-piadezkii* Braun & Crous	Leaf spot		No	No	Yes	No	No	No	No	1, 6
Mycovellosiella vitis-ripariae Braun	*Passalora vitis-ripariae* (Braun) Braun & Crous	Leaf spot		No	No	Yes	No	No	No	No	1, 6

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Monilinia laxa (Aderh. & Ruhland) Honey	*Monilia laxa* (Ehrenb.) Sacc. & Voglino	Fruit rot	Wide host range	No	No	Yes	Yes	Yes	No	No	1, 6, 13
Monilinia fructicola (Winter) Honey	*Monilia fructicola* Batra; *Sclerotinia fructicola* (Winter) Rehm	Brown rot	Wide host range	No	Yes	Yes	No	No	No	Yes	1, 5, 6, 14
Monilinia fructigena Honey	*Monilia fructigena* Pers.:Fr.	Fruit rot		No	Yes	Yes	No	No	No	Yes	1, 6
Monochaetia sarmenti (Pass.) Sacc.	*Pestalotia sarmenti* Pass.			No	No	No	No	No	No	No	1, 6
Monochaetia terminaliae Bat. & Bezerra	*Monochaetinula terminaliae* (Bat. & Bezerra) Muthumary, Abbas & Sutton			No	No	No	No	No	No	No	1, 6
Monochaetia unicornis (Cooke & Ellis) Sacc.	*Lepteutypa cupressi* (Nattrass, Booth & Sutton) Swart; *Pestalotia unicornis* Cooke & Ellis			No	No	No	No	No	No	No	1, 6
Monodictys antiqua (Corda) Hughes			*Platanus*	Yes	No	No	No	No	No	No	1, 5, 6
Myxosporium viticola Dearn. & House				No	No	Yes	No	No	No	No	5, 6

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Nattrassia mangiferae (Syd. & Syd) Sutton & Dyko	*Hendersonula toruloidea* Natrass; *Natrassia toruloidea* (Nattrass) Dyko & Sutton; *Torula dimidiata* Penz.	Leaf spot	Wide host range	No	No	No	No	No	No	No	1, 6
Nectria cinnabarina (Tode) Fr.	*Tubercularia vulgaris* Tode		Wide host range	No	No	Yes	No	No	No	No	5, 6
Nectria viticola Berk. & Curtis				No	No	No	No	No	No	No	1, 5
Neonectria coccinea (Pers.) Rossman & Samuels	*Nectria coccinea* (Pers.) Fr.			No	No	Yes	No	No	No	No	1, 5
Neonectria macrodidyma Halleen, Schroers & Crous	*Cylindrocarpon macrodidymum* Schroers, Halleen & Crous	Black foot disease		No	No	Yes	Yes	Yes	No	No	8
Neonectria neomacrospora (Booth & Samuels) Mantiri & Samuels	*Calonectria macrospora* (Henn. & E. Nyman) Weese; *Nectria neomacrospora* Booth & Samuels			No	No	No	No	No	No	No	1, 6
Neonectria radicola (Gerlac & Nilsson) Mantiri & Samuels	*Cylindrocarpon destructans (Zinssm.) Scholten; Cylindrocarpon radicola* Wollenweb.; *Nectria radicola* Gerlac & Nilsses	Black foot disease		No	No	Yes	No	Yes	No	No	8
Ostreichnion curtisii (Duby) Barr	*Glonium curtisii* (Duby) Lohman; *Hysterium curtisii* Duby		Wide host range	No	No	Yes	No	No	No	No	1, 5

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Pareutypella sulcata Ju & Rogers				No	No	No	No	No	No	No	1, 6
Passalora dissiliens (Duby) Braun & Crous				No	No	Yes	No	No	No	No	1, 6
Passalora vitis (Patil & Sawant) Srivast.	*Cercosporidium vitis* Patil & Sawant	Leaf spot		No	No	Yes	No	No	No	No	1
Patellaria atrata Cooke				No	No	No	No	No	No	No	1, 6
Patellaria viticola Pers.				No	No	No	No	No	No	No	1, 6
Penicillium ardesiacum Novobar		Bunch rot	Wide host range	No	Yes	No	No	No	No	No	1
Penicillium aurantiogriseum Dierckx	*Penicillium cyclopium* Westling; *Penicillium martensii* Thom	Fruit rot	Wide host range	No	No	No	No	No	No	No	6, 13
Penicillium brevicompactum Dierckx	*Penicillium stoloniferum* Thom	Fruit rot	Wide host range	No	No	No	No	No	No	No	13
Penicillium chrysogenum Thom	*Penicillium notatum* Westling	Fruit rot, blue mold	Wide host range	No	No	No	No	No	No	No	13
Penicillium citrinum Thom	*Penicillium steckii* Zalewski	Fruit rot, Peniciliium rot	Wide host range	No	Yes	No	No	No	No	No	13
Penicillium crustosum Thom	*Penicillium farinosum* Novobar	Fruit rot, berry rot	Wide host range	No	Yes	No	No	No	No	No	13
Penicillium decumbens Thom	*Penicillium arabicum* Baghd.	Fruit rot	Wide host range	No	Yes	No	No	No	No	No	1

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Penicillium digitatum (Pers.) Sacc.		Fruit rot	Wide host range	No	No	No	No	No	No	No	13
Penicillium elongatum Dierckx.		Fruit rot	Wide host range	No	Yes	No	No	No	No	No	6, 13
Penicillium expansum Link	*Penicillium crustaceum* Link; *Penicillium glaucum* Link	Bunch rot	Wide host range	No	Yes	No	No	No	No	No	5, 6, 13
Penicillium funiculosum Thom			Wide host range	No	No	No	Yes	No	No	No	1, 5, 6
Penicillium glabrum (Wehmer) Westling	*Penicillium frequentans* Westling	Fruit rot	Wide host range	No	Yes	No	No	No	No	No	1, 5
Penicillium griseoroseum Dierckx	*Penicillium cyaneofulvum* Biourge	Fruit rot, Penicillium rot	Wide host range	No	Yes	No	No	No	No	No	13
Penicillium italicum Wehmer		Fruit rot, blue mold	Wide host range	No	Yes	No	No	No	No	No	13
Penicillium janthenellum Biourge	*Penicillium simplicissimum* (Oedem.) Thom	Fruit rot	Wide host range	No	Yes	No	No	No	No	No	13
Penicillium purpurescens (Sopp) Biourge		Fruit rot	Wide host range	No	Yes	No	No	No	No	No	1
Penicillium rolfsii Thom		Berry rot	Wide host range	No	Yes	No	No	No	No	No	5, 6
Penicillium thomii Maire	*Penicillium aurantioviolaceum* Biourge	Fruit rot	Wide host range	No	Yes	No	No	No	No	No	13
Penicillium variabile Sopp		Fruit rot	Wide host range	No	Yes	No	No	No	No	No	5, 6, 13

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Penicillium viridicatum Westling	*Penicillium olivinoviride* Biourge	Fruit rot	Wide host range	No	Yes	No	No	No	No	No	13
Penicillium vulpinum (Cooke & Masse) Seifert & Samson	*Penicillium claviforme* Bainer	Fruit rot		No	Yes	No	No	No	No	No	13
Penicillum vitis Novobar		Fruit rot	Wide host range	No	Yes	No	No	No	No	No	13
Peniophora albobadia (Schwein.) Boidin	*Dendrophora albobadia* (Schwein.) Chamuris		Wide host range	No	No	Yes	No	No	No	No	1, 5
Perenniporia medulla-panis (Jacq.) Donk	*Fomes unitus* (Pers.) Lowe; *Polyporus unitus* Pers.; *Poria unita* (Pers.) Cooke; *Trametes medulla-panis* (Jacq.) Pat.		Wide host range	No	No	Yes	No	No	No	No	1, 5
Periconia byssoides Pers.	*Periconia pycnospora* Fresen.; *Sporocybe byssoides* (Pers.) Fr.			Yes	No	No	No	No	No	No	5, 6
Pestalotia ampelogena Bres.				No	No	Yes	No	No	No	No	1, 6
Pestalotia europaea Grove				No	No	Yes	No	No	No	No	1, 6
Pestalotia malicola Hori			*Malus*	No	No	Yes	No	No	No	No	1, 6
Pestalotia pezizoides De Not.		Fruit rot	*Rosa*	No	Yes	Yes	No	No	No	No	1, 5, 6

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Pestalotia pitospora Costa & Sousa da Câmara	*Truncatella pitospora* (Costa & Sousa da Câmara) Bissett			No	No	Yes	No	No	No	No	1, 6
Pestalotia ramosa Almeida				No	No	Yes	No	No	No	No	1, 6
Pestalotia thuemenii Speg.	*Zetiasplozna thuemenii* (Speg.) Nag Raj			No	No	Yes	No	No	No	No	1, 6
Pestalotia viticola Cavara	*Monochaetia viticola* (Cavara) Sacc. & D. Sacc.			No	No	Yes	No	No	No	No	1, 6
Pestalotiopsis menezesiana (Bres. & Torrend) Bissett	*Pestalotia menezesiana* Bres. & Torrend	Fruit rot, leaf and stem spot	Wide host range	No	Yes	Yes	No	No	No	No	1, 5, 6
Pestalotiopsis uvicola (Speg.) Bissett	*Pestalotia uvicola* Speg.	Fruit rot	*Carya*	No	Yes	No	No	No	No	No	1, 5, 6
Peziza ascoboloides Bertero	*Patella ascoboloides* (Bertero) Teng; *Scutellinia ascoboloides* (Bertero) Teng			No	No	Yes	No	No	No	No	1,6
Phaeoacremonium aleophilum Gams, Crous, Wingfield & Munai	*Togninia minima* (Tul. & Tu.) Berl.	Petri disease		No	No	Yes	No	Yes	No	No	6, 9, 11
Phaeoacremonium angustius (Gams, Crous, Wingfield & Munai)		Petri diseases		No	No	Yes	No	No	No	No	6, 9, 11
Phaeoacremonium inflatipes (Gams, Crous, Wingfield & Munai)		Petri disease	*Quercus*	No	No	Yes	No	No	No	No	6, 9, 11

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Phaeoacremonium mortoniae Crous & Gams		Petri disease		No	No	Yes	No	No	No	No	11
Phaeoacremonium parasiticum (Ajello, Georg & Wang) Gams, Crous, Wingfield & Munai	*Phialophora parasitica* Ajello, Georg & Wang	Petri disease		No	No	Yes	No	No	No	No	6, 11
Phaeoacremonium rubrigenum Gams, Crous & Wingfield		Petri disease		No	No	Yes	No	No	No	No	9, 11
Phaeoacremonium viticola Dupont		Petri disease		No	No	Yes	No	No	No	No	11
Phaeomoniella chlamydospora (Gams, Crous, Wingfield & Munai) Crous & Gams	*Phaeoacremonium chlamydosporum* (Gams, Crous, Wingfield & Munai)	Black goo, Petri disease		No	No	Yes	No	Yes	No	No	2, 6, 11
Phaeoramularia dissiliens (Duby) Deighton	*Cercospora leoni* Savul. & Rayss; *Cercospora roesleri* (Cattaneo) Sacc.; *Cladosporium roesleri* Catt.; *Isariopsis fuckellii* (Thum) du Plessis; *Ragnhildiana roesleri* (Cattaneo) Vassiljevsky; *Septosporium fuckelii* Thüm.; *Torula dissiliens* Duby	Cercospora leaf spot		No	No	Yes	No	Yes	No	No	1, 3, 6

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Phaeoramularia heterospora (Ellis & Galloway) Dreighton	*Septosporium heterosporum* Ellis & Galloway; *Stigmina vitis* Dearn. & Barth	Leaf spot		No	No	Yes	No	No	No	No	5, 6, 13
Phakopsora euvitis Ono				No	No	Yes	No	No	No	Yes	1, 6
Phakopsora uva Buriticá & Hennen	*Physopella viala* (Lagerh.) Buriticá & Hennen			No	No	Yes	No	No	No	Yes	1, 6
Phakopsora vitis Syd.				No	No	Yes	No	No	No	Yes	1, 6
Phanerochaete crassa (Lév.) Burds.	*Laxitextum crassum* (Lév.) Lentz; *Lopharia vinosa* (Berk.) G. Cunn.; *Porostereum crassum* (Lév.) Hjortstam & Ryvarden; *Stereum umbrinum* Berk. & Curtis		Wide host range	No	No	Yes	No	No	No	No	1, 5
Phanerochaete flavido-alba (Cooke) Rattan	*Peniophora flavidoalba* Cooke, *Peniophora flavidoalba* Cooke	White rot		No	No	Yes	No	No	No	No	1, 5
Phanerochaete viticola (Schwein.) Parmasto	*Corticium viticola* (Schwein.) Fr.; *Peniophora viticola* (Schwein.) Höhn. & Litsch.		Wide host range	No	No	Yes	No	No	No	No	1, 5
Phellinus gilvus (Schwein.) Pat.	*Polyporus gilvus* (Schwein.) Fr.; *Polyporus licnoides* Mont.	Wood rot	Wide host range	No	No	Yes	No	No	No	No	1, 5

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Phellinus igniarius (L.) Quél.	*Fomes igniarius* (L.) Cooke; *Polyporus igniarius* (L.) Fr.	Black measles	Wide host range	No	No	Yes	No	No	No	Yes	1, 5
Phellinus noxius (Corner) Cunn.	*Fomes noxius* Corner			No	No	Yes	No	No	No	No	1, 6
Phellinus viticola (Schwein.) Donk	*Fomes viticola* (Schwein.) Lowe; *Polyporus viticola* Schwein.	Wood rot	Wid host range	No	No	Yes	No	No	No	No	1, 5
Phoma ampelina Berk. & Curtis	*Phomopsis ampelina* (Berk. & Curtis) Grove	Fruit rot		No	Yes	Yes	No	No	No	No	1, 5, 6
Phoma ampelocarpa Pass.				No	No	Yes	No	No	No	No	1, 6
Phoma betae Frank	*Pleospora betae* Björl.			No	No	No	No	No	No	No	1, 6
Phoma confluens Welw. & Curr.	*Dothidella confluens* (Welw. & Curr.) Sacc.			No	No	Yes	No	No	No	No	1, 6
Phoma glomerata (Corda) Wollenweb. & Hochapfel	*Peyronellaea glomerate* (Corda) Goid.	Fruit rot	Wide host range	No	Yes	No	No	No	No	No	13
Phoma negriana Thüm.	*Phyllosticta negriana* (Thüm.) Allesch.			No	No	Yes	No	No	No	No	1, 6
Phoma plurivora Johnst.				No	No	Yes	No	No	No	No	1, 6

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Phoma pomorum Thüm.			Wide host range	No	No	Yes	No	No	No	No	1, 6
Phomopsis amygdali (Del.) Tuset & Portilla	*Fusicoccum amygdali* Del.	Cane blight	*Prunus*	No	No	Yes	No	Yes	No	No	12
Phomopsis longiparaphysata Uecker & Kuo		Phomopsis cane and leaf spot		No	No	Yes	No	No	No	Yes	12
Phomopsis viticola (Sacc.) Sacc.	*Cryptosporella viticola* Shear; *Fusicoccum viticola* Reddik; *Macrophoma viticola* (Cooke) Berl & Voglino; *Metadiplodia subsolitaria f. viticola* (Desm.) Zambett; *Phoma viticola* (Cooke) Sacc.; *Phoma vitis* Bonord; *Sphaeropsis viticola* Cooke	Phomopsis cane and leaf spot, dead arm, excoriose	*Protea, Prunus, Pyrus;*	No	No	Yes	No	Yes	No	No	3, 5, 6, 12, 13
Phomopsis vitimegaspora Kuo & Leu	*Diaporthe kyushuensis* Kajitani & Kanem.	Grapevine swelling arm		No	No	Yes	No	No	No	Yes	6, 11
Phyllachora picea (Berk. & Curtis) Sacc.	*Dothidea picea* Berk. & Curtis			No	No	Yes	No	No	No	No	1, 5
Phyllactinia ampelopsidis Yu & Lai				No	No	Yes	No	No	No	Yes	1, 6

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Phyllactinia guttata (Wallr.) Lév.	*Phyllactinia suffulta* (Rebent.) Sacc.	Powdery mildew		No	No	Yes	No	No	No	No	1, 5, 6
Phyllosticta badhamii Cooke				No	No	Yes	No	No	No	No	1, 6
Phyllosticta dzumajensis Bubák				No	No	Yes	No	No	No	No	1, 6
Phyllosticta microspila Pass.				No	No	Yes	No	No	No	No	1, 6
Phyllosticta pilispora Speschnew				No	No	Yes	No	No	No	No	1, 6
Phyllosticta spermoides Peck.		Leaf spot		No	No	Yes	No	No	No	Yes	1, 5, 6
Phymatotrichum omnivorum Duggar	*Phymatotrichopsis omnivora* (Duggar) Hennebert	Cotton root rot, Phymatotrichum root rot	Wide host range	No	No	No	Yes	No	Yes	No	1, 5, 6, 13
Physalospora abdita (Berk. & Curtis) Stevens	*Physalospora abdita* (Berk. & Curtis) Stevens; *Sphaeria abdita* Berk. & Curtis		Wide host range	No	No	Yes	No	No	No	No	1, 5
Physopella ampelopsidis (Diet. & Syd.) Cummins & Ramachar	*Angiospora ampelopsidis* (Diet. & Syd.) Thirum & Ken.; *Phakopsora ampelopsidis* Diet. & Syd.; *Physopella euvitis* Ono; *Physopella vitis* Arth; *Uredo vitis* Thum	Rust		No	No	Yes	No	No	Yes	No	1, 5, 6, 13
Phytophthora cactorum (Leb. & Cohn) Schrott.		Crown and root rot	Wide host range	No	No	No	Yes	Yes	No	No	1, 3, 6, 13

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Phytophthora cambivora (Petri) Buisman		Root and crown rot		No	No	No	Yes	Yes	No	No	1, 6
Phytophthora cinnamomi Rands		Crown and root rot	Wide host range	No	No	No	Yes	Yes	No	No	1, 6, 10, 13
Phytophthora citricola Sawada		Crown and root rot	Wide host range	No	No	No	Yes	Yes	No	No	1, 6, 13
Phytophthora cryptogea Pethybr. & Laff.		Crown and root rot	Wide host range	No	No	No	Yes	Yes	No	No	6, 10, 13
Phytophthora megasperma Drechs.		Crown and root rot	Wide host range	No	No	No	Yes	Yes	No	No	6, 10, 13
Phytophthora nicotianae Breda de Hann.	*Phytophthora parasitica* Dastar	Crown and root rot	Wide host range	No	No	No	Yes	Yes	No	No	1, 3, 6, 10,13
Pilidiella diplodiella (Speg.) Crous & Van Niekerk	*Coniothyrium diplodiella* (Speg.) Sacc.; *Coniella diplodiella* (Speg.) Petr. & Syd.; *Coniella petrakii* Sutton; *Phoma diplidiella* Speg.	White rot		No	Yes	Yes	No	Yes	No	No	1, 6,20
Pilidiella diplodiopsis Crous & Van Niekerk				No	No	Yes	No	Yes	No	No	20
Pilidium concavum (Desm.) Höhn.	*Ceuthospora concava* Desm.; *Sclerotiopsis concava* (Desm.) Shear & Dodge		*Acer, Camellia, Corylus, Quercus*	No	No	Yes	No	No	No	No	1, 5, 6

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Plasmopara viticola (Berk. & Curtis) Berl & De Toni	*Perenospora viticola* Berk. & Curtis; *Plasmopara amurensis* Prots.	Downy mildew		No	No	No	No	Yes	No	No	1, 3, 5, 6, 13
Pleospora herbarum Karst.	*Stemphylium herbarum* Simmons	Berry rot	Wide host range	Yes	Yes	No	No	No	No	No	1, 5, 13
Pleospora penicillus Fuckel	*Pleospora ambiqua* (Berl. & Bres.) Wehmeyer; *Pleospora media* Niessl;		Wide host range	No	No	Yes	No	No	No	No	1, 5
Pleospora vitis Catt		Bunch rot		No	Yes	No	No	No	No	Yes	1, 6
Pleospora vitis-viniferae Frolov				No	No	No	No	No	No	No	1, 6
Pleospora vulgaris Niessl				No	No	Yes	No	No	No	No	1, 6
Polyporus tenuiculus (Beauv.) Fr.	Favolus brasiliensis *(Fr.) Fr.;* Favolus tenuiculus *Beauv.*		*Carya, Quercus*	No	No	Yes	No	No	No	No	1, 5
Pseudocercospora vulpinae (Ellis & Kellerm.) Braun	*Cercospora vulpinae* Ellis & Kellerm.	Leaf spot		No	No	Yes	No	No	No	No	1, 5, 6
Pseudopezicula tetraspora Korf, Pearson & Zhuang		Angular leaf scorch		No	No	Yes	No	No	No	Yes	1, 5, 6, 13
Pseudopezicula tracheiphila (Mull.-Thurg.) Korf& Zhuang	*Pseudopeziza tracheiphila* Mull.-Thurg; *Phialophora tracheiphila* (Sacc. & Sacc.) Korf	Rotbrenner		No	No	Yes	No	No	No	Yes	1, 13

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Pulcherricium caeruleum (Lam.) Parmasto	*Corticium coeruleum* (Lam.) Fr.; *Terana caerulea* (Lam.) Kuntze		Wide host range	No	No	Yes	No	No	No	No	1, 5
Pyrenochaeta vitis Viala & Sauv.		Leaf spot		No	No	Yes	No	No	No	Yes	1, 5, 6
Pyrenophora phaeocomes (Rebent.) Fr.			*Dactylis*	No	No	Yes	No	No	No	No	1, 6
Pyrenophora phaeocomoides (Berk. & Broome) Sacc.	*Pleospora phaeocomoides* (Berk. & Broome) Winter			No	No	Yes	No	No	No	No	1, 6
Pythium aphanidermatum (Edson) Fitzp.		Root rot	Wide host range	No	No	No	Yes	Yes	No	No	3, 6, 10
Pythium acanthicum Drechsler		Rot	Wide host range	No	Yes	No	Yes	No	No	No	1, 5, 6
Pythium debaryanum Hesse		Root rot	Wide host range	No	No	No	Yes	Yes	No	No	6, 10
Pythium heterothallicum Campb. & Hendrix		Grapevine decline		No	No	No	Yes	Yes	No	No	15
Pythium irregulare Buisman		Grapevine decline	Wide host range	No	No	No	Yes	Yes	No	No	3, 6, 10, 15
Pythium litorale		Grapevine decline		No	No	No	Yes	Yes	No	No	15
Pythium mamillatum Meurs		Root rot	Wide host range	No	No	No	Yes	No	No	No	1, 6
Pythium parasiticum Rajagop. & Ramakr		Rot		No	No	No	Yes	Yes	No	No	1, 3, 6

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Pythium paroecandrum Drechsler		Grapevine decline		No	No	No	Yes	Yes	No	No	15
Pythium pyrilobum Vaartaja		Grapevine decline		No	No	No	Yes	Yes	No	No	15
Pythium rostratifinges		Grapevine decline		No	No	No	Yes	Yes	No	No	15
Pythium rostratum Butler		Root rot	Wide host range	No	No	No	Yes	No	No	No	1, 6, 10
Pythium spinosum Sawada		Grapevine decline	Wide host range	No	No	No	Yes	Yes	No	No	6, 15
Pythium splendens Braun		Root rot	Wide host range	No	No	No	Yes	Yes	No	No	1, 5, 6
Pythium sylvaticum Campbel & Hendrix		Root rot	Wide host range	No	No	No	Yes	Yes	No	No	3, 6, 10
Pythium ultimum var ultimum Trow		Grapevine decline	Wide host range	No	No	No	Yes	Yes	No	No	6, 13, 15
Pythium vexans de Bary		Grapevine decline		No	No	No	Yes	Yes	No	No	1, 6, 15
Pythium violae Chesters & Hickman		Grapevine decline		No	No	No	Yes	Yes	No	No	15
Ramaricium polyporoideum (Berk. & Curtis) Ginns	*Coniophora polyporoidea* (Berk. & Curtis) Burt; *Corticium polyporoideum* Berk. & Curtis; *Phlyctibasidium polyporoideum* (Berk. & Curtis) Jülich; *Trechispora polyporoidea* (Berk. & Curtis) Liberta		*Pinus, Quercus, Robinia*	No	No	Yes	No	No	No	No	1, 5

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Rhabdospora mueggenburgii (Pirotta) Sacc.	*Septoria mueggenburgii* Pirotta			No	No	Yes	No	No	No	No	1, 5
Rhabdospora vitis Koshk. & Frolov				No	No	No	No	No	No	No	1, 6
Rhizoctonia solani Kuhn	*Thanatephorus cucumeris* (Frank) Doak	Root rot	Wide host range	No	No	No	No	No	No	No	1, 5, 6
Rhizopus arrhizus Fischer	*Rhizopus oryzae* Went & Prins.Geerl	Fruit rot, raisYes mold		No	Yes	No	No	No	No	No	5, 6, 13
Rhizopus stolonifer (Ehrenb.:Fr.) Vuill.	*Mucor stolonifer* Ehrenb.	Fruit rot	Wide host range	No	Yes	No	No	Yes	No	No	3, 5, 6, 13
Rhytidhysterium rufulum (Spreng.) Speg.	*Rhytidhysteron rufulum* (Spreng.) Speg.; *Triblidium rufulum* (Spreng.) Ellis & Everh.	Dieback	Wide host range	No	No	No	No	No	No	No	1, 5
Rhytisma vitis Schwein.		Tar spot		No	No	Yes	No	No	No	No	1, 5, 13
Robillarda vitis Prill. & Delacr.				No	No	No	No	No	No	No	1, 6
Rosellinia amblystoma Berl. & Sacc.				No	No	No	Yes	No	No	No	1, 6
Rosellinia aquila (Fr.) Ces. & De Not.	*Sphaeria aquila* Fr.; *Sphaeria byssiseda* Berk.	Root rot	Wide host range	No	No	No	Yes	No	No	No	1, 5, 6
Rosellinia necatrix Berl. Ex Prill.	*Dematophora necatrix* Hartig	White root rot	Wide host range	No	No	No	Yes	Yes	No	No	1, 5, 6, 13
Schizophyllum commune Fr.	*Schizophyllum radiatum* (Sw.) Fr.		Wide host range	No	No	No	No	Yes	No	No	1, 5, 6

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Schizopora paradoxa (Schrad.) Donk	*Irpex paradoxus* (Schrad.) Fr.; *Polyporus vaporarius* sensu Carleton Rea; *Poria vaporaria* sensu Berkeley, Carleton Rea, non Fries	Wood rot	Wide host range	No	No	Yes	No	No	No	No	1, 5
Schizothyrium pomi (Mont. & Fr.) Arx	*Zygophiala jamaicensis* Mason	Flyspeck	Wide host range	No	No	No	No	No	No	No	1, 5, 6
Schizoxylon insigne (De Not.) Rehm	*Oomyces insignis* De Not.		Wide host range	No	No	Yes	No	No	No	No	1, 5
Sclerophora pallida (Pers.) Yao & SpoOner	*Roesleria hypogea* Thum. & Pass.; *Roesleria pallida* (Pers.) Sacc.; *Roesleria subterranea* (Weinmann) Redhead	Root rot	*Malus*	No	No	No	Yes	No	No	Yes	1, 5, 13
Sclerotinia sclerotiorum (Lib.) de Bary	*Sclerotinia libertiana* Fuckel; *Whetzelinia sclerotiorum* (Lib.) Korf & Dumont	Root rot, shoot blight	Wide host range	No	No	Yes	Yes	No	No	No	1, 5, 6, 13
Scytinostroma aluta Lanq.			Salix ;	No	No	No	No	No	No	No	1, 6
Sebacina incrustans (Pers.) Tul. & Tul.	*Corticium incrustans* Pers.		Wide host range	No	No	Yes	No	No	No	No	1, 5
Seimatosorium parasiticum (Dearn. & House) Shoemaker				No	No	Yes	No	No	No	No	1, 6

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Seimatosporium lichenicola (Corda) Shoemaker & Muller	*Corynuem microstictum* Berk. & Broome; *Discostroma corticola* (Fuckel) Brockm.	Canker	Wide host range	No	No	No	No	No	No	No	1, 6
Seimatosporium lonicerae (Cooke) Shoemaker				No	No	Yes	No	No	No	No	1, 6
Seiridium unicorne (Cooke & Ellis) Sutton	Lepteutypa cupressi (*Nattrass, C. Booth & Sutton) Swart;* Pestalotia unicornis *Cooke & Ellis*	Leaf spot		No	No	Yes	No	No	No	No	1, 5
Septoria ampelina Berk. & Curtis		Septoria leaf spot, melanose		No	No	Yes	No	No	No	Yes	1, 5, 6, 13
Septoria badhamii Berk. & Broome				No	No	No	No	No	No	No	1, 6
Septoria kellermaniana Thüm.				No	No	Yes	No	No	No	No	1, 5
Septoria vineae Pass.				No	No	No	No	No	No	No	1, 6
Septoria viticola Berk. & Curtis	*Phyllostictina viticola* (Berk. & M.A. Curtis) Petr.	Leaf spot		No	No	Yes	No	No	No	No	1, 5, 6
Setosphaeria rostrata Leonard	*Bipolaris rostrata* (Drechs.); *Drechslera rostrata* (Drechs.); *Exserohilum rostratum* (Drechs.) Leonard & Suggs; *Helminthosporium rostratum* Drechs.	Leaf spot, necrosis	Wide host range	No	No	Yes	No	No	No	No	1

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Sporidesmium rauii Ellis & Harkn.				No	No	Yes	No	No	No	No	5, 6
Sporocadus rhododendri (Schwein.) Morelet	*Coryneum rhododendri* Schwein.			No	No	Yes	No	No	No	No	1, 6
Stachybotrys lobulata Berk.	*Stachybotrys chartarum* (Ehrenb.) Hughes			No	No	No	No	No	No	No	1, 6
Stagonospora bulgarica Vanev				No	No	No	No	No	No	No	1, 6
Stereum hirsutum Willd.:Fr. Gray	*Stereum complicatum* Fr. Fr	Wood rot, esca	Wide host range	No	No	Yes	No	No	No	Yes	1, 5, 13
Stictis viticola Sherwood				No	No	Yes	No	No	No	No	1, 5
Stigmatolemma poriiforme (Pers.) Cooke	*Solenia poriiformis* (DC.) Fuckel; *Stigmatolemma poriaeforme* (Pers.) Cooke		*Juglans, Platanus, Populus, Quercus*	No	No	Yes	No	No	No	No	1, 5
Stigmina esfandiarii Petr.				No	No	No	No	No	No	No	1, 6
Strickeria trabicola (Fuckel) Winter	*Teichospora trabicola* Fuckel			No	No	No	No	No	No	No	1, 6
Thyridaria viticola (Ellis & Everh.) Wehm.	*Dermatella viticola* Ellis & Everh.; *Pseudovalsa viticola* Ellis & Everh.			No	No	Yes	No	No	No	No	1, 5, 6
Thyridium vitis Ellis & Everh.	*Mycothyridium vitis* (Ellis & Everh.) Petr.			No	No	Yes	No	No	No	No	1, 5

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Tilletiopsis minor Nyland			Acer, Chrysanthe mum	No	No	Yes	No	No	No	No	1, 5, 6
Tilletiopsis washingtonensis Nyland			Wide host range	No	No	Yes	No	No	No	No	1, 6
Togninia minima (Tul. & Tul.) Berl	*Pleurostoma minimum* (Tul. & Tul.) Barr, Rogers & Ju		Wide host range	No	No	Yes	No	No	No	No	1, 6
Tomentella atramentaria Rostr.	*Thelephora atra* Weinm.			No	No	Yes	No	No	No	No	1, 6
Tomentella bryophila (Pers.) Larsen	*Sporotrichum viticola* Schwein.		Wide host range	No	No	Yes	No	No	No	No	1, 6
Trametes hirsuta (Wulfen) Pilát	*Coriouls hirsutus* (L.:Fr.) Pat.; *Polyporus hirsutus* (Wulfen) Fr.	Esca	Wide host range	No	No	Yes	No	No	No	No	1,5
Trametes versicolor (Wolfen) Fr.	*Coriolus versicolor* (Wolfen.:Fr.) Quael; *Polyporus versicolor* (Wolfen.:Fr.)	White rot	Wide host range	No	No	Yes	No	No	No	No	1, 5
Trametes zonata Wettst.				No	No	No	No	No	No	No	1, 6
Trichcladium asperum Harz				Yes	No	No	No	No	No	No	1, 5, 6
Trichothecium roseum (Pers.) Hirk	*Cephalothecium roseum* Corda; *Trichoderma roseum* Pers.	Fruit rot	Wide host range	No	Yes	No	No	No	No	No	5, 6

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Trullula melanochlora (Desm.) Höhn.				No	No	No	No	No	No	No	1, 6
Truncatella angustata (Pers.) Hughes	*Pestalotia angustata* (Pers.) Arx		Wide host range	No	No	Yes	No	No	No	No	1, 6
Tubeufia pezizula (Berk. & Curtis) Barr	*Lasiosphaeria pezizula* (Berk. & Curtis) Sacc.; *Thaxteriella pezizula* (Berk. & Curtis) Petr. *Melanomma helicophilum* (Cooke) Sacc.			No	No	Yes	No	No	No	No	1, 5
Typhula viticola (Peck) Berthier	*Pistillaria viticola* Peck			No	No	Yes	No	No	No	No	1, 5
Valsa ceratosperma (Tode) Maire	*Cytospora rosarum* Grev.; *Sphaeria ceratosperma* Tode; *Valsa rosarum* De Not.		Wide host range	No	No	Yes	No	No	No	No	1, 5
Valsa vitigera Cooke				No	No	Yes	No	No	No	No	1, 5
Valsaria insitiva (Tode) Ces. & De Not.	*Diatrype viticola* Schwein. ex Berk.			No	No	Yes	No	No	No	No	1, 6
Vararia pectinata (Burt) Rogers & Jacks.	*Corticium pectinatum* Burt			No	No	Yes	No	No	No	No	1, 5
Vermicularia compacta Cooke & Ellis				No	No	No	No	No	No	No	1, 6

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Verticillium dahliae Kleb.	*Verticillium ovatum* Berk. & Jacks.	Wilt	Wide host range	No	No	Yes	No	No	No	No	5, 6, 13
Xylaria arbuscula Sacc.				No	No	Yes	No	No	No	No	1, 6
Xylaria polymorpha (Pers.) Grev.	*Sphaeria polymorpha* Pers.; *Xylosphaera obovata* (Berk.) Dennis; *Xylosphaera polymorpha* (Pers.) Dumort.	White rot	Wide host range	No	No	Yes	No	No	No	No	1, 5

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19. Van Niekerk, J.M., Groenewald, J.Z.. Farr, D.F., Fourie, P.H., Halleen, F., and Crous, P.W. 2005. Reassessment of *Phomopsis* species on grapevines. Australasian Plant Pathology 34: 27-39.
20. Van Niekerk, J.M., Groenewald, J.Z., Verkley, J.M., Fourie, P.H., Wingfield, M.J., and Crous, P.W. 2004. Systematic reappraisal of *Coniella* and *Pilidiella*, with specific reference to species occurring on *Eucalyptus* and *Vitis* in South Africa. Mycological Research 58: 283-303.

Table 3. Records deleted from original list of fungal pathogens of *Malus* spp.

Scientific Name	Reason
Antrodia albida (Fr.) Donk	No association with *Malus* spp.
Ascochyta pericola	No association with *Malus* spp.
Aspergillus awamori Nakaz.	No association with *Malus* spp.
Aspergillus foetidus Thom & Raper	No association with *Malus* spp.
Aspergillus luchuensis Inui	No association with *Malus* spp.
Aspergillus niger var. awamori (Nakaz.) Al-Musallam	No association with *Malus* spp.
Botryosphaeria stevensii Shoemaker	No association with *Malus* spp.
Botrytis mali	Validity of species remains uncertain
Cerastomella mali	No information available
Coniella musaiaensis var. hibisci Sutton	No association with *Malus* spp.
Coniospora mali	No information available
Coniothyrium armeniacae Hollós	No information available
Coniothyrium pirinum	No information available
Coniothyrium tirolense Bubák	No information available
Coriolellus sepium (Berk.) Murrill	No association with *Malus* spp.
Corticium utriculicum Cunn.	No information available
Cucurbitaria acervata (Fr.) Fr.	No information available
Cylindrocarpon obtusisporum (Cooke & Harkn.) Wollenw.	No association with Malus spp.
Daedalea sepium (Berk.) Aoshima	No association with Malus spp.
Dendrothele tetracornis Boidin & Duhem	No information available
Diaporthe pomigena	No information available
Diplodia pyri	No information available
Discosia barrusii	No information available
Dothiorella iberica	No information available
Dothiorella sarmentorum	No information available
Entoleuca callimorpha Syd.	No information available
Fracchiaea heterogenea Sacc.	No information available
Fusarium camptoceras Wollenw. & Reinking	No information available
Fusarium moniliforme Sheld.	No association with *Malus* spp.
Fusarium moniliforme var subglutinans	No information available
Glabrocypella brunneocrystallina	No information available
Greeneria uvicola (Berk. & Curtis) Punith.	No association with *Malus* spp.
Gymnosporangium confusum Plowr.	No association with *Malus* spp.
Gymnosporangium cornutum Arthur ex F. Kern	No association with *Malus* spp.
Haplosporella ailanthi	No association with *Malus* spp.
Hirneola auricula-judae (L.) Berk	No association with *Malus* spp.
Hydnum schiedermayeri Heufl.	No association with *Malus* spp.
Hyphodontia gossypina (Parmasto) Hjortstam	No association with *Malus* spp.
Hyphodontia spathulata (Schrad.) Parmasto	No association with *Malus* spp.
Leptosphaeria ternata Hazsl	No association with *Malus* spp.
Leptosphaeria vagabunda Sacc.	No association with *Malus* spp.
*Lopadostoma polynesium (*Berk. & Curtis) Rappaz	No information available
Melanconium fuligineum (Scribn. & Viala) Cavara	No association with *Malus* spp.
Nattrassia mangiferae (Syd. & Syd.) Sutton & Dyko	No association with *Malus* spp.
Nectria tawa Dingley	No association with *Malus* spp.
Neonectria radicicola (Gerlach & Nilsson) Mantiri & Samuels	No association with *Malus* spp.
Penicillium diversum Raper & Fennell	No association with *Malus* spp.
Penicillium islandicum Sopp	No association with *Malus* spp.

Scientific Name	Reason
Peniophora violaceolivida (Sommerf.) Massee	No association with *Malus* spp.
Pestalotia breviseta Sacc.	No association with *Malus* spp.
Pestalotia disseminata	No association with *Malus* spp.
Pestalotiopsis montellica (Sacc. & Voglino) Tak. Kobay.	No association with *Malus* spp.
Pestalotiopsis steyaertii Mordue	No association with *Malus* spp.
Peziza corticola	No information available
Phaeosphaeria catacrypta	No information available
Phoma enteroleuca Sacc.	No association with *Malus* spp.
Phoma rubefaciens Togliani	No association with *Malus* spp.
Phomopsis fukushii Endŏ & Tanaka	No association with *Malus* spp.
Phyllosticta persicae Sacc.	No association with *Malus* spp.
Phytophthora arecae	No association with *Malus* spp.
Phytophthora capsici Leonian	No association with *Malus* spp.
Phytophthora infestans (mont.) de Bary	No association with *Malus* spp.
Plagiostoma alneum (Pers.) Arx	No association with *Malus* spp.
*Pleospora scrophulariae (*Desm.) Höhn.	No association with *Malus* spp.
Pleosporum herbarum var citrorum	No association with *Malus* spp.
Polyporus sepium (Berk.) Cunn.	No association with *Malus* spp.
Puccinia heterospora Katajev	No association with *Malus* spp.
Pythium acanthophoron Sideris	No association with *Malus* spp.
Robillarda cavarae Tognini	No information available
Rosellinia amblystoma Berl. & Sacc.	No information available
Rosellinia subiculata (Schwein.) Sacc.,	No association with *Malus* spp.
Sclerotinia kenjiana	No information available
Steccherinum ciliolatum (Berk. & Curtis) Gilb. & Budington	No association with *Malus* spp.
*Strasseria geniculata (*Berk. & Broome) Höhn.	No association with *Malus* spp.
Trametes sepium Berk	No association with *Malus* spp.
Trichoderma harzianum Rifai.	No association with *Malus* spp.
Tryblidiella rufula Spreng.) Sacc.	No association with *Malus* spp.
Tyromyces sepium (Berk.) Cunn.	No association with *Malus* spp.

Table 4. Records deleted from original list of fungal pathogens from *Vitis* spp.

Scientific Name	Reason
Capnodium elongatum Berk. & Desmaz	Doubtful record
Coniothyrium viticora	Doubtful record
Dendrophoma pleospora	No information available
Diatrypella vitis	No information available
Doratomyces microsporus	No information available
Fomitiporia australiensis	No information available
Fomitiporia avenaceum	No information available
Guignardia baccae	No information available
Haplosporella ailanthi	No information available
Haplosporella fabaeformis	No information available
Hendersoniella toruloideea	No information available
Hendersonula toruloides	No information available
Lophiostoma marcrostomum	No information available
Perenniporia tenuis (Schwein.) Ryvarden	No association with *Vitis* spp.
Phyllosticta succedanea	No information available
Septoria buharica	No information available
Stegonsporium viticola	No information available

Table 5. Fungal pathogens of *Malus* spp. that occur in South Africa of which specimens are lodged at National Collection (PREM/PPRI)

Scientific Name	Synonym	Voucher Specimen/ Culture
Bjerkandera adusta (Willd.) Karst. (PREM 51188,	*Boletus adustus* Willd; *Polyporus adustus* (Willd.) Fr. (PREM 44641); *Polyporus crispus* (Pers.) Fr.; *Polystictus adustus* (Willd.) Fr.; *Tyromyces adustus* ((Willd.) Pouzar	Yes
Botryosphaeria obtusa (Schwein.) Shoemaker	*Botryodiplodia juglandicola* (Schwein.) Sacc.; *Physalospora cydoniae* Arnaud (PREM 20670, PREM 26643, PREM 30130; *Physalospora malorum* Peck.; *Physalospora obtusa* (Schwein.) Cooke (PREM 20670, PREM 34404); *Sphaeropsis malorum* (Schwein.) Cooke (PREM 12519, PREM 14108, PREM 17792, PREM 31875, PREM 46218, PREM 48735); *Sphaeria obtusa* Schwein.; *Valsa juglandicola* (Schwein.) Cooke	Yes
Botryosphaeria ribis Grossenbacher & Duggar	*Botryodiplodia ribis* Gross. & Duggar f. *chromogena* Gross. & Duggar (PREM 23674, PREM 40685); *Botryodiplodia ribis* (Fuckel) Petr.; *Botryosphaeria berengeriana* De Not.; *Botryosphaeria mali* Putterill; *Dothiorella ribis* (Fuckel) Sacc.; *Fusicoccum aesculi* Corda; *Fusicoccum tingens* Goid.; *Podosporium* ribis Fuckel	Yes

Scientific Name	Synonym	Voucher Specimen/ Culture
Cheiromycella chomatospora (Corda) Boerema, Dorenb. & Kesteren	*Coniothecium chomatosporum* Corda (PREM 19841, PREM 19850, PREM 19868, PREM 21935, PREM 23680, PREM 26640, PREM 27659, PREM 33267, PREM 33371, PREM 33464, PREM 33759, PREM 34547)	Yes
Chondrostereum purpureum (Pers.) Pouzar (PREM 51183, PREM 51190)	*Stereum purpureum* Pers.; (PREM 45918); *Stereum rugosiusculum* Berk. & Curtis	Yes
Coriolopsis polyzona (Pers.) Ryvarden	*Fomes wombaliensis* Beeli; *Microporus polyzonus* (Pers.) Kuntze; *Polystictus polyzonus* (Pers.) Cooke; *Trametes devexa* Berk. (PREM 1230); *Trametes tomentosa* Van der Byl	Yes
Corticium laetum (Karst.) Bres. (PREM 1217, PREM 27267, PREM 20669)	*Corticium anthochroum (*Pers.) Fr.; *Erythricium laetum* (Karst.) Erikss. & Hjortstam; *Hyphoderma laetum* Karst.; *Sporotrichum anthochroum* (Pers.) Pers.	Yes
Diapleella coniothyrium (Fuckel) Barr	*Coniothyrium fuckelii* Sacc. (PREM 27268); *Kalmusia coniothyrium* (Fuckel) Huhndorf; *Leptosphaeria coniothyrium* (Fuckel) Sacc. *Melanomma coniothyrium* (Fuckel) Holm; *Sphaeria coniothyrium* Fuckel	Yes

Scientific Name	Synonym	Voucher Specimen/ Culture
Diaporthe ambigua Nitschke	*Diaporthe eres* Nitschke; *Diaporthe mali* Miura; *Diaporthe perniciosa* Marchal; *Phoma mali* Schulzer & Sacc. (PREM 20412); *Phomopsis ambigua* (Sacc.); *Phomopsis mali* Roberts; *Phomopsis perniciosa* Grove	Yes
Erythricium salmonicolor (Berk. & Broome) Burds.;	*Botryobasidium salmonicolor* (Berk. & Broome); *Corticium salmonicolor* Berk. & Broome (PREM 31998, PREM 40477, PREM 40478); *Necator decretus* Massee; *Pellicularia salmonicolor* (Berk. & Broome) Dastur	Yes
Fusicoccum africanum Van der Byl (PREM 46280)		Yes
Gloeodes pomigena (Schwein.) Colby (PREM 27576, PREM 33117)	*Dothidea pomigena* Schwein.; *Marssonina coronariae* (Sacc. & Dearn.) Davis; *Marssonia mali* Henn.; *Leptothyrella mali* (Henn.) Hara; *Phyllachora pomigena* (Schwein.) Sacc.;	Yes

Scientific Name	Synonym	Voucher Specimen/ Culture
Glomerella cingulata (Stoneman) Spaulding & Schrenk (PREM 29961, PREM 33119)	*Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc.; *Gloeosporium rufomaculans* (Berk.) Thüm; *Glomerella miyabeana* (Fukushi) Arx; *Glomerella rubicola* (Stoneman) Spauld. & Schrenk; *Glomerella rufomaculans* (Berk.) Spauld. & Schrenk (PREM 21931)	Yes
Leucostoma persoonii (Nitschke) Höhn.	*Cytospora leucostoma* (Pers.) Sacc.; (PREM 7734, PREM 14681, PREM 17791, PREM 18188, PREM 26704, PREM 27266, PREM 27691, PREM 41637, PREM 49371, PREM 45106, PREM 46342, PREM 47000); *Leucostoma leucostoma* (Pers.) Togashu{?}; *Sphaeria leucostoma* Pers.; *Valsa leucostoma* (Pers.) Fr. (PREM 23346); *Valsa persoonii* Nitschke	Yes
Mycosphaerella pomi (Pass.) Lindau	*Cylindrosporium pomi* Brooks; *Phoma macrostoma* Mont.; *Phoma mali* Schulzer & Sacc. (PREM 20412); *Phoma pomi* Schulzer & Sacc.; *Phyllosticta limitata* Peck; *Phyllosticta mali* Prill. & Delacr.; *Sphaerella pomi* Pass.	Yes

Scientific Name	Synonym	Voucher Specimen/ Culture
Nectria ditissima Tul. & C. Tul. (PREM 31890)	*Cylindrocarpon willkommii* (Lindau) Wollenw.; *Fusarium willkommii* Lindau; *Nectria major* (Wollenw.) J. Moravec	Yes
Penicillium expansum Link (PPRI 5654)	*Coremium glaucum* Link; *Coremium vulgare* Corda; *Floccaria glauca* Greville; *Penicillium crustaceum* Link; *Penicillium glaucum* Link	Yes
Pezicula malicorticis (Jackson) Nannf.	*Cryptosporiopsis curvispora* (Peck) Gremmen; *Cryptosporiopsis malicorticis* (Cordley) Nannf.; *Cryptosporiopsis perennans* (Cordley) Nannf.; *Macrophoma curvispora* Peck *Neofabraea malicorticis* Jackson; *N. perennans* Kienholz; *Pezicula perennans* (Kienholz) Dugan, Roberts & Grove	Yes
Podosphaera leucotricha (Ellis & Everh.) Salmon (PREM 430, PREM 448, PREM 1077, PREM 1079, PREM 1291, PREM 9531, PREM 18059, PREM 47671, PREM 47845, 48447)	*Albugo leucotricha* (Ellis & Everh.) Kuntze; *Oidium farinosum* Cooke; *Oidium mespili* Cooke; *Sphaerotheca leucotricha* Ellis & Everh; *Sphaerotheca castagnei* Lev. *f.* mali Sorauer; *Sphaerotheca mali* Burr.	Yes
Rhizoctonia solani Kühn (PREM 47018)	*Moniliopsis solani* (Kühn) Moore; *Pellicularia solani* (Kühn) Exner; *Thanatephorus cucumeris* (Frank) Donk	Yes

Scientific Name	Synonym	Voucher Specimen/ Culture
Schizophyllum commune Fr. (PREM 23361, PREM 48565, PREM	*Agaricus alneus* Reichard; *Schizophyllum alneum* Schröt.; *Schizophyllum multifidum* (Batsch) Fr.; *Schizophyllum radiatum* (Sw.) Fr.	Yes
Schizothyrium pomi (Mont. & Fr.) v. Arx	*Asterina gaultheriae* Curtis; *Epipeltis gaultheriae* (Curtis) Theiss.; *Leptothyrium pomi* (Mont.: Fr.) Sacc. (PREM 33118); *Microthyriella paludosa* Booth; *Microthyriella rubi* Petr.; *Schizothyrium gaultheriae* (Curtis) Hohn; *Zygophiala jamaicensis* Mason	Yes
Trametes versicolor (L. ex. Fr.) Pilat	*Boletus versicolor* L.; *Coriolus versicolor* (L.) Quel.; (PREM 51189, PREM 51193); *Polyporus versicolor* (L. ex. Fr.) Quel.	Yes
Venturia inaequalis (Cooke) Winter (PREM 17827, PREM 20437, PREM 20665, PREM 47952)	*Cladosporium dendriticum* Wallr.; *Fusicladium dentriticum* (Wallr.) Fuckel (PREM 12845, PREM 30469, PREM 30474, PREM 46704, PREM 47979); *Fusicladium pomi* (Fr.) Lind.; *Sphaerella inaequalis* Cooke; *Spilocaea pomi* Fr. (PREM 50952); *Spilosticta inaequalis* (Cooke) Petr.; *Sphaeria cinerascens* Fuckel	Yes

Table 6. Fungal pathogens of *Vitis* spp. that occur in South Africa of which specimens are lodged at National Collection of Fungi (PREM/PPRI).

Scientific name	Synonyms/Other stages	Voucher Specimen/ Culture
Alternaria alternata (Fr.) Keissl. (PREM 55102)	*Alternaria fasciculata* (Cooke & Ellis) Jones & Grout; *Alternaria rugosa* McAlpine; *Alternaria tenuis* Nees; *Macrosporium fasciculatum* Cooke & Ellis; *Torula alternata* Fr.	
Alternaria vitis Cavara (PREM 7394)	*Macrosporium vitis* Sorokīn	Yes
Asperisporium vitiphyllum (Speschnew) Deighton	*Cercospora vitiphylla* (Speschnew) Barbarin; *Coryneum vitiphyllum* Speschnew; *Exosporium sultanae* du Plessis (PREM 9360, PREM 12514, PREM 51498); *Stigmina esfandiari* Petrak ; *Scolicotrichum vitiphyllum* (Speschnew) Karak. & Vassiljevsky	Yes
Aureobasidium pullulans (de Bary) Arnaud	*Aureobasidium pullulans var. pullulans* (de Bary) Arnaud; *Aureobasidium vitis* Viala & Boyer; *Exobasidium vitis* (Viala & Boyer) Prill. & Delacr. (PREM 12514)	Yes
Botryotinia fuckeliana (de Bary) Whetzel	*Botrytis cinerea* Pers. Fr. (PREM 46336); *Sclerotinia fuckeliana* (de Bary) Fuckel	Yes
Elsinoe ampelina (de Bary) Shear	*Gloeosporium ampelophagum* (Pass.) Sacc. (PREM 24876, PREM 46192); *Sphaeceloma ampelinum* de Bary (PREM 734, PREM 4619, PREM 7142, PREM 7225, PREM 7447, PREM 15056, PREM 15057, PREM 15653, PREM 24876, PREM 27355, PREM 30886, PREM 32637, PREM 46192)	Yes
Erysiphe necator Schwein.	*Oidium tuckeri* Berk.; *Uncinula americana* Hawe; *Uncinula necator* (Schwein.) Burrill (PREM 6608, PREM 7306, PREM 7273, PREM 7314, PREM 48898, PREM 48899)	Yes

Scientific name	Synonyms/Other stages	Voucher Specimen/ Culture
Eutypa lata (Pers.:Fr.) Tul. & Tul.	*Cytosporina lata* Höhn.; *Eutypa armeniacae* Hansf. & Carter (PREM 47639, PREM 40844); *Libertella blepharis* Smith	Yes
Mycosphaerella personata Higgins	*Cercospora vitis* (Lev) Sacc.; (PREM 1087, PREM 1173, PREM 1182, PREM 7283, PREM, PREM 7462, PREM 7612, PREM 33299, PREM 33489, PREM 34493); *Cercospora viticola* (Ces.) Sacc. (PREM 1087, PREM 1173, PREM 1182, , PERM 2025, PREM 7462, PREM 7612, PREM 30765, PREM 32636, PREM 32701); *Cladosporium viticola* Ces.; *Cladosporium vitis* (Lev.); *Isariopsis clavispora* (Ber. & Curtis) Sacc; *Phaeoisariopsis vitis* (Lev.) Speg.; *Pseudocercospora vitis* (Lev.) Speg.	Yes
Phaeoramularia dissiliens (Duby) Deighton	*Cercospora leoni* Savul. & Rayss (PREM 33155, PREM 33898, PREM 46976, PREM 46968); *Cercospora roesleri* (Cattaneo) Sacc.; *Cladosporium roesleri* Catt.; *Isariopsis fuckellii* (Thum) du Plessis (PREM 48477); *Ragnhildiana roesleri* (Cattaneo) Vassiljevsky; *Septosporium fuckelii* Thüm. (PREM 7975); *Torula dissiliens* Duby	Yes
Phomopsis viticola (Sacc.) Sacc. (PREM 56626,PREM 56628, PREM 56629, PREM 56630, PREM 56631)	*Cryptosporella viticola* Shear; *Fusicoccum viticola* Reddik (PREM 30481); *Macrophoma viticola* (Cooke) Berl & Voglino; *Metadiplodia subsolitaria f. viticola* (Desm.) Zambett; *Phoma viticola* (Cooke) Sacc.; *Phoma vitis* Bonord; *Sphaeropsis viticola* Cooke	Yes
Plasmopara viticola (Berk. & Curtis) Berl & De Toni (PREM 286, PREM 1276, PREM 1534, PREM 7223, PREM 7237, PREM 7313, PREM 10132)	*Perenospora viticola* Berk. & Curtis; *Plasmopara amurensis* Prots.	Yes

3. RESOLVING THE STATUS OF *MONILINIA* SPP. IN SOUTH AFRICAN STONE FRUIT ORCHARDS

ABSTRACT

Geographical distribution records of pathogens and pests are the basis for phytosanitary decision-making. *Monilinia fructicola*, one of the three *Monilinia* species responsible for brown rot of stone fruit, is listed as an A1-regulated pest for South Africa and is not known to occur in South African stone fruit orchards. This is supported by several surveys carried out from 1985 in South African stone fruit orchards, which showed that *M. laxa* is the only causal agent of brown rot in South Africa. However, many disputes have arisen during the past years as records have been published regarding the presence of this pathogen in South Africa prior to 1985. A detection survey was conducted after a notification of non-compliance (interception of regulated pests) was received by the National Plant Protection Organisation of South Africa stating that *M. fructicola* was detected on consignments of South African *Prunus* fruit (*P. domestica*) in the United Kingdom. *Monilinia* isolates were collected from the identified orchards at various stages throughout the year. Molecular techniques with species-specific primers for *M. fructicola* and *M. laxa* based on the EPPO Diagnostic Protocol for *M. fructicola* were used for the identification of the isolates. The absence of *M. fructicola* from South African stone fruit orchards was again confirmed by this study and its status in South Africa can be reported as: absent, not known to occur, confirmed by a detection survey. The regulated status of *M. fructicola* in South Africa is therefore scientifically justified by the findings from this study.

INTRODUCTION

Brown rot is one of the most important pre- and post harvest fungal diseases known to the fruit industry (Ogawa and English, 1991; Holst-Jensen *et al.*, 1997; Michailides and Morgan, 1997). Three species of the fungal genus *Monilinia*, namely *Monilinia fructicola* (Winter) Honey, *M. laxa* (Aderhold & Ruhland) Honey and *M. fructigena* (Aderhold & Ruhland) Honey serve as the casual organisms of brown rot (Byrde and Willets, 1977;

Ogawa *et al.*, 1995; Snyder and Jones, 1999). The three species do not occur in all areas where stone fruit are grown. *M. fructicola*, known as the American brown rot fungus, is common in the Americas, Australia and New Zealand (CABI/EPPO, 1999), whilst the other two species, indigenous in Europe, are known as the European brown rot fungi (CABI/EPPO, 1991, 2000). All the species are known only to occur in Central and Eastern Asia, where *Prunus, Malus* and *Pyrus* spp. originated (CABI/EPPO, 1991, 1999, 2000). During 2004, *M. fructicola* was reported for the first time in China after the pathogen was intercepted by the United Kingdom on *Prunus* fruits imported from China in 2003 (OEPP/EPPO, 2004).

The brown fungi are polytrophs and they can attack a wide range of members of the Rosaceae. The main host range of *M. fructicola* and *M. laxa* are cultivated *Prunus* spp. - peaches, cherries, plums, prunes, nectarines and apricots. On rare occasions, pome fruit (apples and pears) are attacked by *M. fructicola*. Pome fruit are the primary hosts of *M. fructigena*. Recent reports from Japan, Canada and Australia claim that *M. fructicola* was the causative organism isolated from diseases of grapes and strawberries (OEPP/EPPO, 1988; Washington and Pascoe, 2000; Sholberg *et al.*, 2003). World-wide, amongst the three *Monilinia* species, *M. fructicola* is considered the most destructive. *M. fructicola* is responsible for severe economic losses on stone fruit in America and Australia. Currently, the pathogen is classified as an A1- regulated pest for South Africa (Anonymous, 2005). *M. fructicola* was moved from the A1-regulated pest list (pests not present in the region) of the European Plant Protection Organisation (OEPP/EPPO) to the A2 pest list (pests present in some EPPO countries) after the detection of this pathogen in Austria and France (OEPP/EPPO, 2002a, 2002b, 2005).

Monilinia fructicola overwinters in orchards as mycelium on fruit stems, blighted blossoms, twigs and cankers, but primarily on mummified fruit that fall to the ground or remain hanging in the trees (CPC, 2005). Two types of spores, conidia and ascospores, may be produced under humid conditions in spring that infect blossoms, twigs and young fruit. In contrast to the European brown rot fungi, the teleomorph stage is important in the life cycle of *M. fructicola* (CPC, 2005). Infected fruit normally become mummified but when infection occurs at or near harvest, post harvest rot may develop. Any type of injury can serve as an entry point for the fungus such as hail damage, insect feeding wounds, bird pecks, fruit cracking, limb rubs, twig punctures, picking and packing injuries. Infection can also progress from blossoms to twigs to fruit (Emery *et al.*, 2000). The typical disease symptoms induced by *M. fructicola* are similar on all stone fruit and include blossom and twig blight, cankers and fruit rot (Ogawa *et al.*, 1995). The fungus can locally be dispersed by wind and by some insects such as *Drosophila melanogaster* (Michailides and Spotts, 1990). Internationally, the most likely means of dispersal is with vegetative planting material, rooted plants and fresh fruit of susceptible genera (OEPP/EPPO, 1988; EPPO/CABI, 1997).

Similar brown rot symptoms are caused by the three *Monilinia* spp. and these species can be distinguished by laboratory examination only. The species are morphologically similar in culture and the greatest difficulty is experienced to distinguish between isolates of *M. fructicola* and *M. laxa* (OEPP/EPPO, 1988; EPPO/CABI, 1997, Lane, 2002). Diagnostic keys are almost exclusively based on qualitative traits such as colony characteristics (Batra, 1979; Sonoda *et al.*, 1982; Van Leeuwen and Van Kesteren, 1998), sporulation density (Jenkins, 1965; Byrde and Willets, 1977; Van Leeuwen and Van Kesteren, 1998), germ tube features (Van Leeuwen and Van Kesteren, 1998; Wormald, 1920) and interactions between the colonies (Sonoda *et al.*, 1982). However, different opinions have appeared in the literature concerning the characteristics that are most typical for the two species (Ogawa and English, 1954; Sonoda and Ogawa, 1982). Problems are especially experienced with the identification of the so-called atypical isolates of *M. fructicola* and *M. laxa* that do not have the typical characteristics as described for the type cultures (Aderhold and Ruhland, 1905; Honey, 1928), especially in cases where diagnostic personnel less familiar with the three species encounter difficulties in interpreting the described qualitative characteristics. In order to solve these problems, several other laboratory-based detection and identification techniques were developed. These techniques are an electrophoresis method, using total mycelial protein SDS-PAGE analysis (Belisario *et al.*, 1999), differentiation in mycelial growth under long-wave UV light (De Cal and Melgarejo, 1999) and an ELISA testing with monoclonal antibodies (Hughes *et al.*, 1999). However, with the increasing global movement of fresh fruit, quarantine surveillance became more challenging. Rapid methods for accurate identifications of potential quarantine pests without having to culture fungi became a necessity, especially with consignments of fresh fruits at harbour and dock sites that might have to be detained.

Detection and identification methods based on molecular biology were increasingly providing the means for timely and rapid detection and identification of potential quarantine pests (Henson and French, 1994; Ristaino *et al.*, 1998; Martin *et al.*, 2000;

Bindslev *et al.*, 2002; Schaad and Frederick, 2002). The sensitivity of these molecular techniques, such as the polymerase chain reaction (PCR), enable direct detection of pathogens in the host without the prior need for isolating and culturing the pathogen. Several studies reported species-specific PCR primers for the identification of *M. fructicola*. These were based on the ribosomal small subunit (Fulton and Brown, 1997), ribosomal internal transcribed spacer (ITS) regions (Fulton *et al.*, 1999; Snyder and Jones, 1999; Förster and Adaskaveg, 2000; Hughes *et al.*, 2000; Ioos and Frey, 2000; Côte *et al.*, 2004a, 2004b), or unique species-specific repetitive sequences (Boehm *et al.* 2001; Ma *et al.* 2003). However, some of these methods only differentiate *M. fructicola* from *M. laxa* but have not been validated to distinguish *M. fructicola* from *M. fructigena.* Hughes *et al.* (2000) and Ioos and Frey (2000) according to the EPPO Council responsible for the approval of EPPO Standards developed the most reliable PCR primers. These two primer sets were included into the standard approved by the EPPO council that describes a diagnostic protocol for *M. fructicola*, a regulated pest for EPPO (OEPP/EPPO, 2003a).

Monilinia fructicola is listed as an A1-regulated pest for South Africa. For a pathogen to be classified as an A1-pest the pest should be of economic importance to the endangered area and not yet present there or present but not widely distributed and being officially controlled (FAO, 2002). Many disputes have arisen during the past years concerning this classification due to official records of the presence of this pathogen dating back to the 1950s. The situation is further complicated by recent reports from some European countries of the detection of *M. fructicola* on stone fruit imported from South Africa (OEPP/EPPO, 1999, 2003b; Van Leeuwen *et al.*, 2001). The first reference concerning the presence of *M. fructicola* in South Africa was made by Doidge *et al.* in 1953. Similar information was published by Heyns (1967) and Gorter (1977) about the presence of this pathogen in the South Western and Southern Cape and also sporadic in Transvaal. To ascertain whether this pathogen is present on stone fruit in the South Western and Southern Cape surveys were conducted. The results of these surveys were based solely on qualitative traits depending on colony characteristics and confirmed that *M. fructicola* was not present in these two stone fruit production areas and that brown rot in South Africa is caused by *M. laxa* only (Matthee, 1970; Schlagbauer and Holz, 1987; Den Breeyen, 1994; Fourie *et al.*, 2002).

However, a notification of non-compliance (interception of regulated pests) was received by the NPPO of South Africa during April 2003 from the Plant Health Division of the Department of Environment, Food and Rural Affairs of the United Kingdom (DEFRA) stating that *M. fructicola* was detected on consignments of *Prunus* fruit (*P. domestica*) traced back to orchards in South Africa (OEPP/EPPO, 2003b). The orchards from where the fruit originated were traced to production units located in the Gauteng Province (previously known as the Transvaal) and to fruit of the plum cultivars Flavor King, Songold and Leatitia. Previous records about the presence of *M. fructicola* in South Africa, has stated occurrence in the former Transvaal Province (Gorter, 1977).

In order to scientifically resolve the status of *Monilinia* spp. in South Africa, a detection survey has been conducted according to the terms of international standards for phytosanitary measures (ISPM). The ISPM of particular relevance are ISPM No. 6 "Guidelines for surveillance" (FAO, 1997) and ISPM no. 8 "Determination of pest status in an area" (FAO, 1998). The aim of this study was to ascertain whether *M. fruticola* is present in South African stone fruit orchards based on EPPO-approved molecular techniques (OEPP/EPPO, 2003a) for the identification of the species, and thereby address its status as an A1-regulated pest in South Africa.

MATERIALS AND METHODS

Detection survey. The survey was conducted relevant to the biology of *M. fructicola* in the identified orchards of the three plum cultivars located in the Gauteng Province. Three Songold orchards and three Leatitia orchards of 3.43 and 3.68 hectares, respectively, as well as one Flavor King orchard of 1.4 hectare, with 1000 trees per hectare were inspected and sampled. The Songold and Leatitia orchards were established in 1997, 1998 and 2000 and the Flavor King orchard in 1997.

The number of trees per orchard inspected for symptoms, which included decayed or mummified fruit, blossom and twig blight and cankers, was determined according the statistical method of Cannon and Roe (1982). To provide for a 95% confidence of sampling, 138 trees were randomly sampled from the 1 100 trees per hectare. The threshold prevalence in the identified orchards was 2%.

The first inspection and sampling was at bud burst during August 2003 and all the orchards were monitored for mummified fruit that had fallen to the ground or remained hanging in the trees, as well as for cankers with profuse gumming. The second inspection and sampling was at full bloom stage during September 2003 when all the orchards were monitored for symptoms of blossom and twig blight. The third inspection and sampling was during October 2003 when all the orchards were monitored for twig blight symptoms and young fruit symptoms. The final inspection and sampling were carried out at latter stages of harvesting during December 2003 and January 2004 with special emphasis on fruit expressing brown rot symptoms.

Fungal isolates and colony characteristics. Isolations were made from the samples and small pieces of tissue were plated directly onto malt agar (MA; Biolab, Midrand, South Africa), potato carrot agar (PCA; 20g Biolab agar, 20g carrot, 20g potato, 1000 ml water) and potato dextrose agar (PDA; Biolab, Midrand, South Africa) amended with 2% streptomycin. The plates were incubated at 25°C. Plates were monitored daily for presumptive *Monilinia* isolates based on general colony characteristics. Hyphae growing out from the tissue pieces were subcultured onto fresh PDA and water agar (WA; Biolab) to induce sporulation. Isolates were incubated at 25°C under near-ultraviolet light. Presumptive positive isolates were hyphal-tipped to obtain pure cultures and maintained on PDA. Disks of all the cultures (6 days old) were transferred to oatmeal agar (OMA; Biolab) in petri dishes and placed in a pattern as described by Sonoda *et al.* (1982) to examine the interaction between the different cultures.

DNA isolation and amplification using species-specific primers for the identification of *M. fructicola*. All the presumptive positive *Monilinia* isolates were grown on PDA. Twenty isolates collected from stone fruit during an earlier study (Fourie *et al.*, 2002) were also included. The total genomic DNA was extracted by using the Qiagen® DNeasy® Plant Maxi Kit (Strasse, Hilde, Germany). The species-specific primer pair 5'-TATGCTCGCCAGAGGATAATTA-3' (*Mfc*-F1) and 5'-GATTTTAGAGCCTGCCATTA-3' (*Mfc*-R1) developed by Hughes *et al.* (2000) was used in the amplification reaction. These primers are based on subtle DNA sequence differences in the ITS 1 and 2 regions of the nuclear rRNA gene repeat. The species-specific primer pairs were custom synthesised by Integrated DNA Technologies, Inc (Coralville, IA, USA). The amplification with the species-specific primers for *M. fructicola* was performed using the PCR conditions recommended by Hughes *et al.* (2000)

as published in the EPPO-approved diagnostic protocol for *M. fructicola* (OEPP/EPPO, 2003a), except for the annealing temperature, which was increased from 59°C for 1 min to 62.5°C for 30 s. Positive controls (DNA of *M. fructicola*, which was obtained from The Central Science Laboratory, Sand Hutton, York, United Kingdom) and negative controls (using water instead of template DNA) were included. PCR products were analysed by electrophoresis at 100 V for 1 h in a 1 % (w/v) agarose gel and visualised under UV light using a Genegenius Gel Documentation and Analysis System (Syngene, Cambridge, United Kingdom) after ethidium bromide staining.

DNA isolation and amplification using species-specific primers for the identification of *M. laxa*. Thirty isolates were randomly selected. The species-specific primer pair 5'-TATGCTCGCCAGAGAATAATC-3' (IST1*Mlx*) and 5'-TGGGTTTTGGCAGAAGCACACC-3' (IST4*Mlx*) developed by Ioos and Frey (2000) was used in the amplification reaction. These primers are based on base substitutions between the three *Monilinia* species clustered in two polymorphic regions, one located in the ITS1 and the other in the ITS2. The species-specific primer pairs were custom synthesised by Integrated DNA Technologies, Inc. The amplification with the species-specific primers for *M. laxa* was performed using the PCR conditions recommended by Ioos and Frey (2000) as published in the diagnostic protocol for *M. fructicola*, provided by EPPO (OEPP/EPPO, 2003a). Positive controls (DNA of *M. laxa*, which was obtained from The Central Science Laboratory, Sand Hutton, York, UK) and negative controls (using water instead of template DNA) were included. DNA of *M. fructicola* and *M. fructigena* (obtained from The Central Science Laboratory, Sand Hutton, York, UK) were also included. PCR products were analysed by electrophoresis at 100 V for 1 h in a 1 % (w/v) agarose gel and visualised under UV light using a Genegenius Gel Documentation and Analysis System (Syngene, Cambridge, UK) after ethidium bromide staining.

RESULTS

Detection survey. A total of 414 trees for each of the Sungold and Leatitia orchards and 138 trees for Flavor King were monitored at each of the four inspection intervals. During the surveillance period a total of 98 samples were collected from the Flavor King orchard, 154 from Leatitia and 168 from Songold. Mummified fruit and canker symptoms on twigs were the most prevalent type of symptom found in the identified orchards.

Fungal isolates and morphology. Of the 420 samples taken during the surveillance period, 172 presumptive *Monilinia* isolates were obtained through visual examination based on morphological features such as colony margins, lobing and colour of the sporulating areas. On the oatmeal agar plates, no distinct black lines, which are a positive identification for *M. fructicola*, were observed between cultures after 10 days of incubation. A light line was, however, observed between some of the cultures. For conclusive identification, 90 isolates, 30 each of the different cultivars, were selected for molecular analysis.

DNA isolation and amplification using species-specific primers for the identification of *M. fructicola*. None of the 90 DNA samples of the presumptive positive isolates or DNA from the 20 isolates from Fourie *et al.* (2002) gave positive results following PCR amplification with the species-specific primers for *M. fructicola*. Only DNA from the 3 *M. fructicola* positive controls yielded an amplicon of 280 bp (Figures 1 - 4).

DNA isolation and amplification using species-specific primers for the identification of *M. laxa*. All the samples gave positive results following PCR amplification with the species-specific primers for *M. laxa* (Figure 5). All the isolates, including the positive control (DNA of *M. laxa*) yielded an amplicon of 350 bp. No amplification was observed in the lanes containing the reference DNA of *M. fructicola* or *M. fructigena* (Figure 5).

DISCUSSION

Distribution records of pests are the basis for phytosanitary decision-making. It is therefore imperative for NPPOs to have access to accurate information about the geographical distribution of pests. In order to obtain this information, accurate identification of these pathogens or pests is crucial and the assurance of the accuracy of this information is very important. Records should preferably be based on results of surveys or positive identifications published in peer-reviewed publications (Van Halteren, 2000). According to the WTO-SPS, phytosanitary measures have to be scientifically justified and in practice it means that NPPOs must have access to scientific documentation that they can site as justification in cases of any possible dispute. Furthermore, another logical consequence of the WTO-SPS is more detailed justification of the absence ("not known to occur") or presence ("known not to occur") of pests in countries (Van Halteren, 2000). This allows importing countries to demand for a better justification of the absence of pathogens or pests from exporting countries and on the other hand allows importing countries to provide more justification for their quarantine measures. Not knowing whether a specific pathogen or pest is present in a country has too often in the past allowed that country to restrict the imports of certain commodities. For a country to establish the presence of a specific pathogen or pest might be costly as this would require extensive surveys and expert diagnostic skills.

In this study, a molecular approach was followed to establish the presence of *M. fructicola* in South African stone fruit orchards after a thorough detection survey was conducted. None of the isolates tested with the species-specific PCR primers gave positive results for *M. fructicola.* The PCR test was performed using the PCR conditions of the EPPO-approved and recommended diagnostic protocol for *M. fructicola* (OEPP/EPPO, 2003a). Annealing temperature was adjusted to 62.5°C for 30 s to eliminate non-specific amplification which was observed at the recommended annealing temperature of 59°C for 1 min. This resulted in more stringent PCR conditions, which enhanced the specificity of primers especially where target organisms displayed a low number of differences (base substitutions). The absence of *M. fructicola* was validated by the positive results following PCR of 30 randomly selected isolates with species-specific primers for *M. laxa*.

Since 1985, various surveys were conducted in stone fruit orchards in all the production areas (Western Cape and Gauteng) and *M. fructicola* has never been detected (Matthee, 1970; Schlagbauer and Holz, 1987; Den Breeyen, 1994; Fourie *et al.*, 2002). This study therefore confirms these reports, which were based on morphology and provides the scientific justification to the NPPO of South Africa to support the status of *M. fructicola* as an A1-regulated pest. The status of *M. fructicola* in South Africa can therefore be described as: "Absent, not known to occur, confirmed by a detection survey".

This study also demonstrates the advantage of molecular detection to provide a rapid, specific, sensitive and reliable detection and identification diagnostic protocol to detect *M. fructicola*. This protocol (OEPP/EPPO, 2003a), as optimised in this study, provides a valuable tool to determine the presence of *M. fructicola* in consignments of imported plant material and fresh fruits. However, the apparent false positive identification that led to the notification of non-compliance (EPPO, 2003b) highlights the importance of sufficient positive and negative controls. Moreover, as no species-specific primer could possibly be validated against all micro-organisms that might inhabit the target host or substrate, the relevant PCR product should also be identified through sequence analysis or restriction enzyme digestion (Retief *et al.*, 2006) and such identifications should be corroborated with morphological identification.

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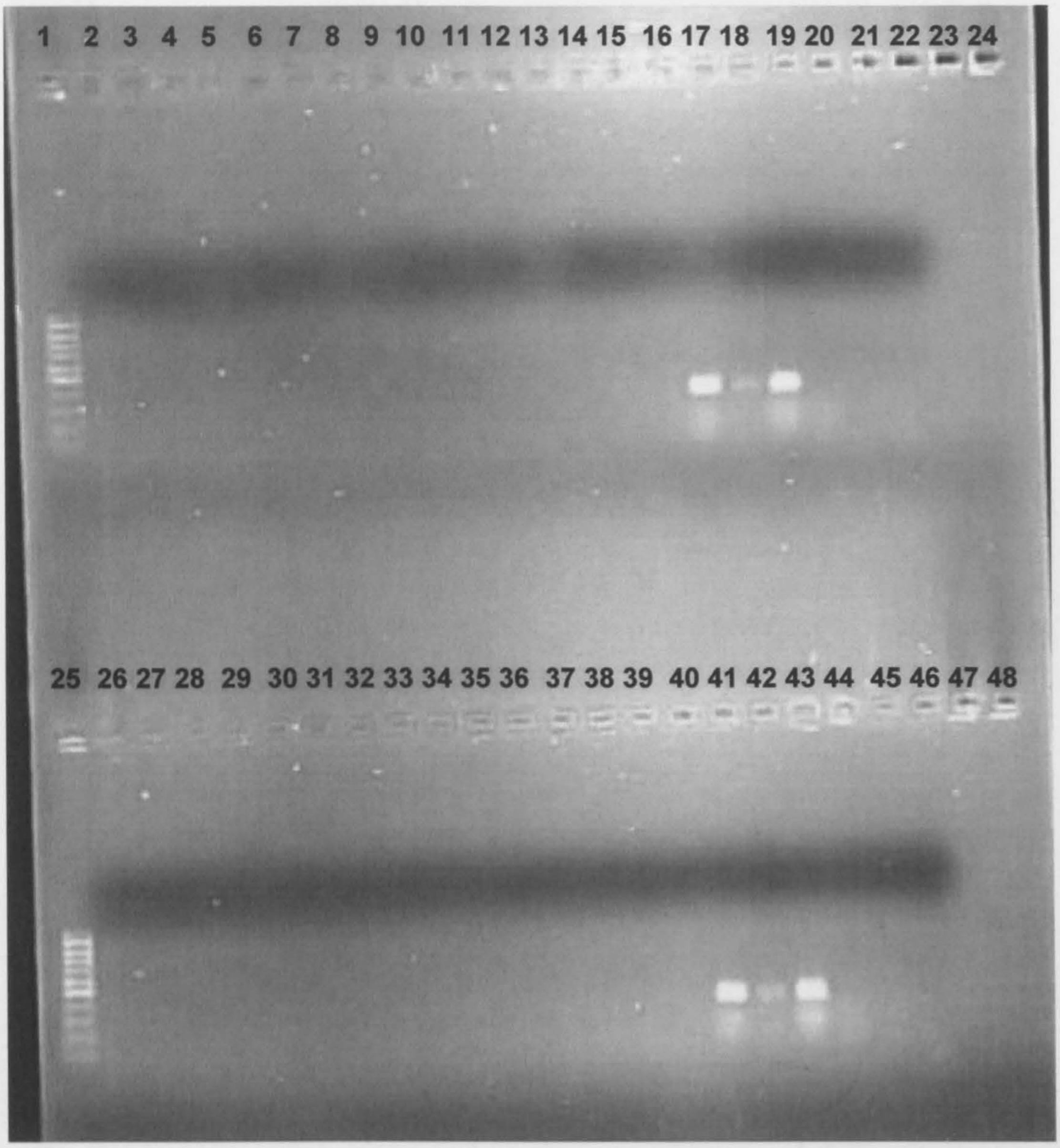

Figure 1. Gel documentation of PCR products following PCR amplification of DNA extracted from *Monilinia* cultures ex 'Leatitia' plum with species-specific primers for *M. fructicola*. Samples on the gel are as follows: lane 1 denotes a 100-bp DNA ladder; lanes 2 – 16, isolates from 'Leatitia' plum. Isolates in lanes 17 – 19, lane 20 and lane 21 are *M. fructicola*, *M. laxa* and *M. fructigena* positive controls; lane 22 denotes a negative water control; lane 25 denotes a 100-bp DNA ladder; lanes 26 – 40, isolates from 'Leatitia' plum. Isolates in lanes 41 – 43, lane 44 and lane 45 are *M. fructicola*, *M. laxa* and *M. fructigena* positive controls; lane 46 denotes a negative water control.

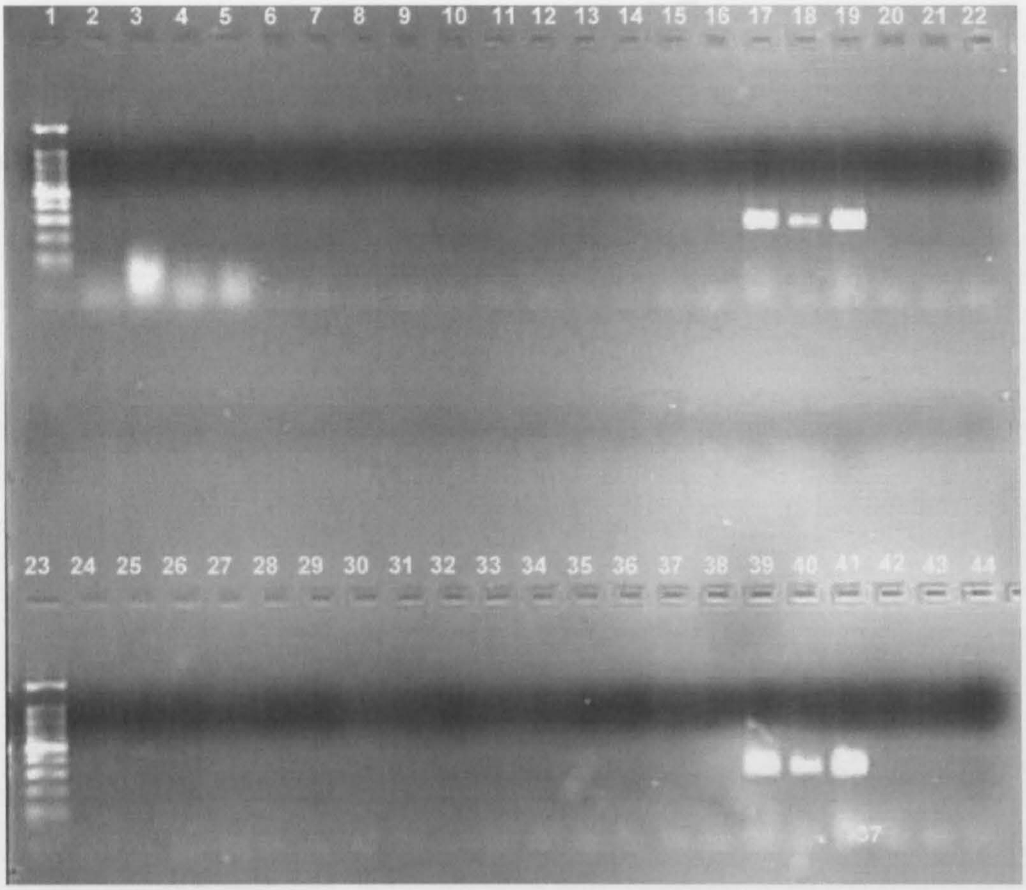

Figure 2. Gel documentation of PCR products following PCR amplification of DNA extracted from *Monilinia* cultures ex 'Songold' plum with species-specific primers for *M. fructicola*. Samples on the gel are as follows: lane 1 denotes a 100-bp DNA ladder; lanes 2 – 16, isolates from 'Songold' plum. Isolates in lanes 17 – 19, lane 20 and lane 21 are *M. fructicola*, *M. laxa* and *M. fructigena* positive controls; lane 22 denotes a negative water control; lane 23 denotes a 100-bp DNA ladder; lanes 24 – 38, isolates from 'Songold' plum. Isolates in lanes 39 - 41, lane 42 and lane 43 are *M. fructicola*, *M. laxa* and *M. fructigena* positive controls; lane 44 denotes a negative water control.

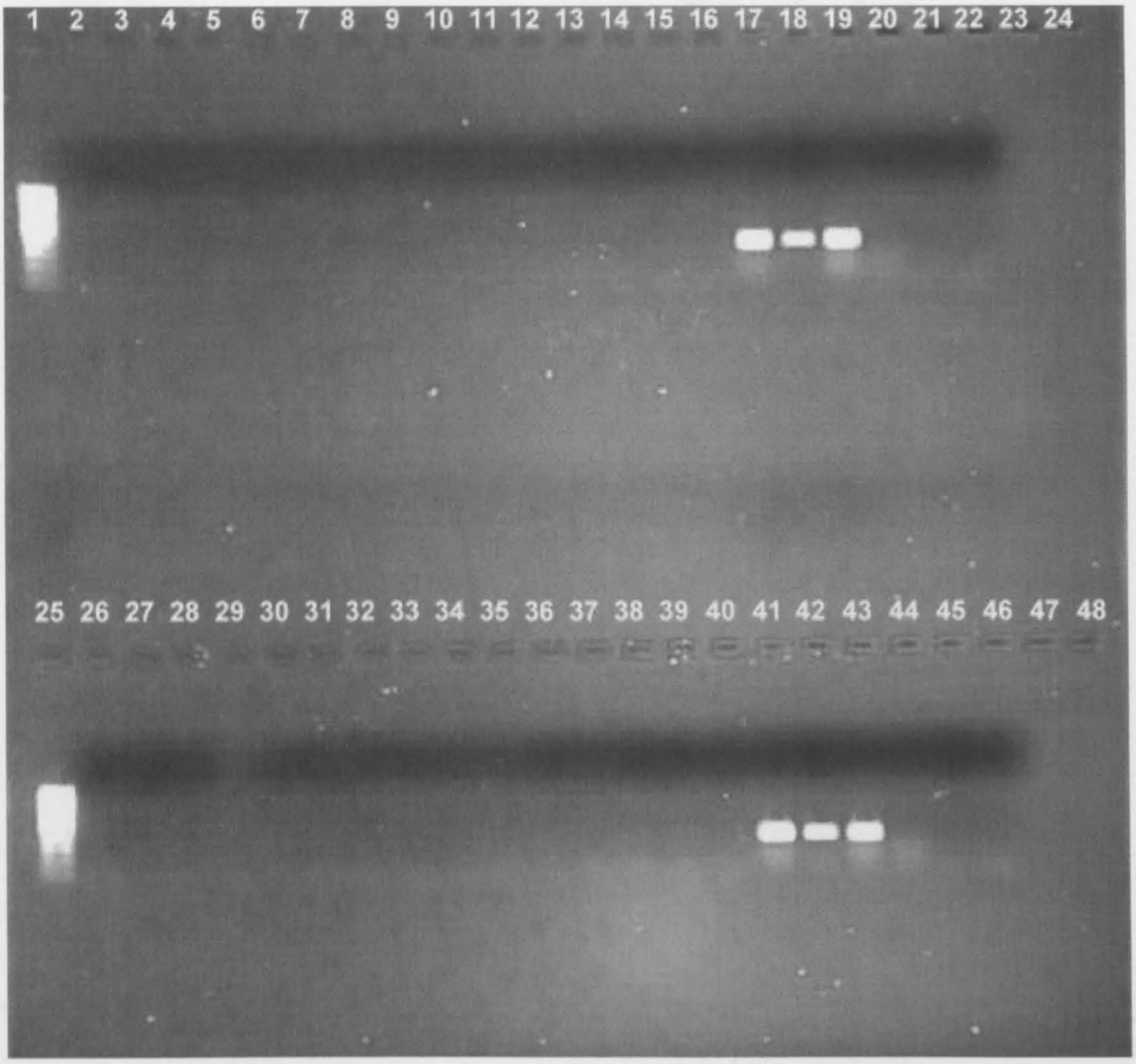

Figure 3. Gel documentation of PCR products following PCR amplification of DNA extracted from *Monilinia* cultures ex 'Flavor King' plum with species-specific primers for *M. fructicola*. Samples on the gel are as follows: lane 1 denotes a 100-bp DNA ladder; lanes 2 – 16, isolates from 'Flavor King' plum. Isolates in lanes 17 – 19, lane 20 and lane 21 are *M. fructicola*, *M. laxa* and *M. fructigena* positive controls; lane 22 denotes a negative water control; lane 25 denotes a 100-bp DNA ladder; lanes 26 – 40, isolates from 'Flavor King' plum. Isolates in lanes 41 – 43, lane 44 and lane 45 are *M. fructicola*, *M. laxa* and *M. fructigena* positive controls; lane 46 denotes a negative water control.

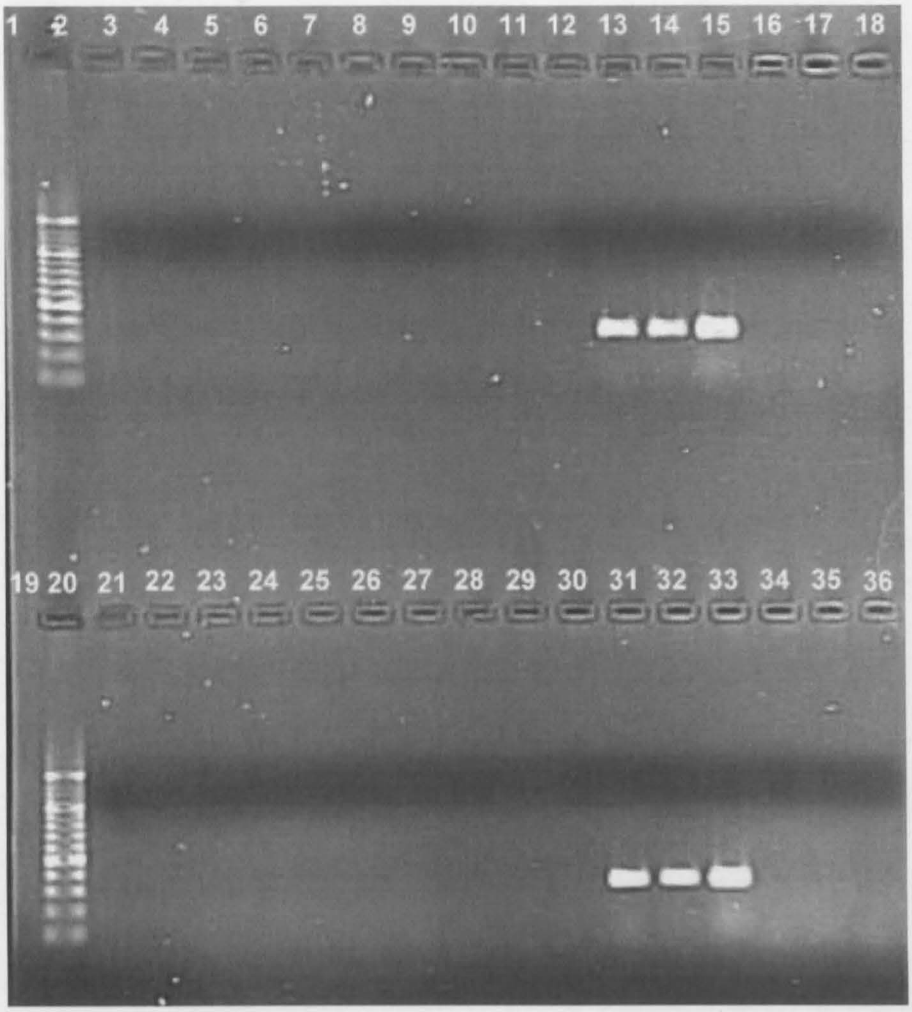

Figure 4. Gel documentation of PCR products following PCR amplification of DNA extracted from *Monilinia* cultures ex *Prunus* cultivars with species-specific primers for *M. fructicola*. Samples on the gel are as follows: lane 1 denotes a 100-bp DNA ladder; lanes 2 – 12, isolates from *Prunus* cultivars. Isolates in lanes 13 - 15, lane 16 and lane 17 are *M. fructicola*, *M. laxa* and *M. fructigena* positive controls; lane 18 denotes a negative water control; lane 20 denotes a 100-bp DNA ladder; lanes 21 - 30, isolates from *Prunus* cultivars. Isolates in lanes 31 - 33, lane 34 and lane 35 are *M. fructicola*, *M. laxa* and *M. fructigena* positive controls; lane 36 denotes a negative water control.

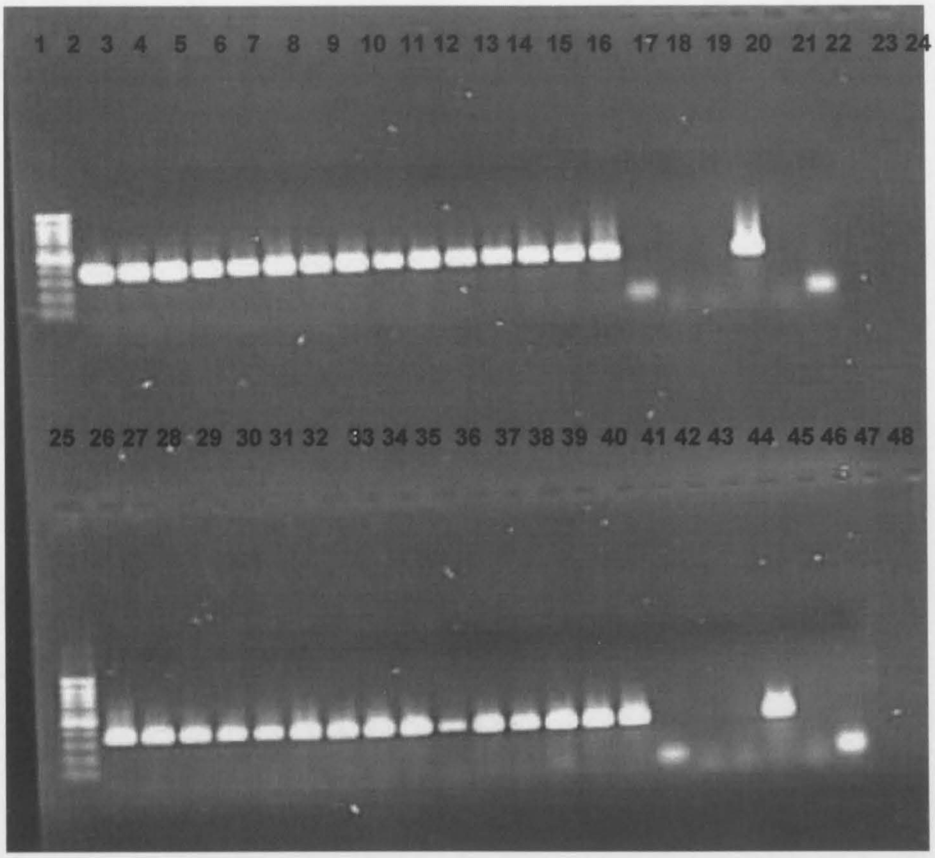

Figure 5. Gel documentation of PCR products following PCR amplification of DNA extracted from *Monilinia* cultures ex 'Leatitia', 'Songold' and 'Flavor' King plums with species-specific primers for *M. laxa*. Samples on the gel are as follows: lane 1 denotes a 100-bp DNA ladder; lanes 2 – 16, isolates from 'Leatitia', 'Songold' and 'Flavor King' plums. Isolates in lanes 17 – 19, lane 20 and lane 21 are *M. fructicola*, *M. laxa* and *M. fructigena* positive controls; lane 22 denotes a negative water control; lane 25 denotes a 100-bp DNA ladder; lanes 26 – 40, isolates from 'Leatitia', 'Songold' and 'Flavor King' plums. Isolates in lanes 41 – 43, lane 44 and lane 45 are *M. fructicola*, *M. laxa* and *M. fructigena* positive controls; lane 46 denotes a negative water control.

4. RESOLVING THE STATUS OF *NEONECTRIA GALLIGENA* IN SOUTH AFRICA

ABSTRACT

The occurrence of fruit pathogens is currently one of the main factors involved in controlling quarantine-related market access. It is therefore imperative for countries to have access to accurate information regarding the geographical distribution of pathogens within their boundaries. Unconfirmed South African records pertaining to the presence of the causative agent of European canker of apples, *Neonectria galligena*, have been the cause of many disputes regarding its status as an A1-regulated pest in this country. To clarify this issue, presumptive positive isolates of *N. galligena*, isolated from symptomatic apple trees from the major apple producing areas in South Africa, were identified by means of species-specific molecular primers designed for *N. galligena*. These data were supplemented by a morphological re-examination of all previous herbarium specimens presumed to be *N. galligena*. Results from this study revealed that none of the samples tested positive for *N. galligena*, nor were any of the herbarium specimens representative of a *Neonectria* species. These findings support the fact that the current A1-regulated status of *N. galligena* in South Africa is justified.

INTRODUCTION

The fungal pathogen, *Neonectria galligena* (Bres.) Rossman & Samuels (Synonym *Nectria galligena* (Bres.); anamorph *Cylindrocarpon heteronema* (Berk. & Broome) Wollenw.) is the causative organism of the economic important disease known as European canker, Nectria canker, apple canker, pear canker or perennial Nectria canker (Booth, 1967; Agrios, 1988; Jones and Sutton, 1996; CABI Bioscience, 2004; Mantiri *et al.*, 2004). This pathogen has been recorded on more than 60 hardwood tree and shrub species from over 20 genera, and displays limited host specificity (Flack and Swinburne, 1977; Sinclair *et al.*, 1993; Anagnostakis and Ferrandino, 1998). Economic losses attributable to *N. galligena* are the most severe on apples and pears, although losses to forest trees have also been recorded. An additional source of economical loss associated with this pathogen, is fruit rotting of apples, known as eye-rot. This rot may develop in orchards or during periods of prolonged storage (Swinburne, 1975). Foliage is not affected by this pathogen (CPC, 2005).

Neonectria galligena survives unfavourable environmental conditions as mycelium in cankers on twigs and branches. Perithecia may also develop in cankered wood during the winter. Ascospores and conidia (macroconidia) are produced in the spring after the onset of moist conditions, and serve as primary inoculum. Macroconidia, which develop in sporodochia, are the most common form of inoculum in the United States (Horst, 1990; Jones and Aldwinckle, 1990). The fungus can infect all ages of apple wood (McCracken *et al.*, 2003). The development of the characteristic canker symptoms follows infection through wounds of various kinds, such as leaf scars, pruning wounds, bud-scale scars at bud burst, tree tie wounds, sunscald lesions, lesions caused by other pathogens such as *Venturia inaequalis* (Swinburne, 1975) and burrknots (Wilson, 1966; Dubin and English, 1974; Swinburne, 1975; Xu *et al.*, 1998). When cankers are formed on side shoots or minor branches the damage could be relatively insignificant and the infected parts can be removed, but when the cankers are formed on the main stem or on a major branch, the whole tree could be lost (Cooke, 1999). Yield losses are a direct consequence of the damage caused by the pathogen to productive shoots and branches. In severe situations, whole orchards can become uneconomical and in some instances entire orchards or plantations have been removed. Annual losses of 1-10% are common in young apple orchards (Jones and Aldwinckle, 1990). Infection of fruit occurs on the tree at the blossom or stem end, either through open calyxes, lenticels, scab lesions or insect wounds (Swinburne, 1975). Fruit infections usually remain quiescent until the fruit is placed in storage (Dewey *et al.* 1995). Infected apples become mummified, which remain on the trees or floor of the orchards, and serve as a source of inoculum for further infections (Swinburne, 1975).

In forest trees, the presence of cankers on stems and the associated invasion by the pathogen can cause severe damage, leading to significant reduction in the quality of the logs, value and inevitable loss in merchantable timber volume (Sinclair *et al.*, 1993; Plante and Bernier, 1997; CPC, 2005).

In the field, spores are dispersed mainly by rain and wind (Horst, 1990). Internationally, the fungus is dispersed in vegetative propagation plant material, rooted plants (Howard *et al.*, 1974; McCracken *et al.*, 2003) and fruit (CPC, 2005). Spread through vegetative plant material is compounded by the fact that *N. galligena* can remain symptomless in young orchards for 3-4 years (Lovelidge, 1995; McCraken *et al*., 2003).

Identification of this pathogen requires isolation on culture medium. However, the frequency of recovery, even from typical canker symptoms, is greatly reduced by the presence of endophytic fungi and other species closely related to *N. galligena* growing as saprobes within the woody tissues (CPC, 2005). Several studies showed that infection could become established in nurseries, from where it is carried with asymptomatic material to orchards (Lovelidge, 1995; Langrell, 2002; McCraken *et al*., 2003). Conventional isolation to detect latent infections is often hindered by the presence of other endophytic fungi (Brown *et al*., 1993). Although isolations can be improved by antibacterial supplements to the medium, no selective medium for the isolation of this pathogen is currently available. To overcome these problems, new approaches have been investigated to develop more sensitive diagnostic methods for the detection of latent infections in wood, as well as quiescent fruit infections.

Monoclonal antibodies specific to *N. galligena* were produced, but although this technique enables the detection of the pathogen from lesions, it was not successful for detection of latent infections (Dewey *et al.* 1995; CPC, 2005). Molecular techniques such as the polymerase chain reaction (PCR) are widely used for the sensitive detection and identification of plant pathogenic fungi (White *et al*., 1990; Henson *et al*., 1993; Ferreria *et al*., 1996; Hamelin *et al.* 1996; Pennanen *et al*., 2001). The first molecular attempt to identify *N. galligena* was in 1993 when a species-specific primer was designed to detect *Cylindrocarpon heteronema* in apple wood (Brown *et al.,* 1993). The design of the primer was based on the variable internal transcribed spacer (ITS) region of the ribosomal DNA (rDNA), which at that time was an attractive target for the development of species-specific primers for the detection of fungal pathogens (Nazar *et al*., 1991; Mills *et al*., 1992). This method was further developed to identify DNA polymorphisms in the rDNA, as well as the mitochondrial (mt) DNA of *C. heteronema*. This was used as markers for studying intraspecific variation in the process of identification of infection sources (Brown *et al*., 1994). In 1998, species-specific primers were described that were based on the presence of intron polymorphisms in the small subunit (SSU) rDNA (Crockard *et al*., 1998; Johansen and Haugen, 1999). Although a PCR detection method was developed by Brown *et al.* (1993), it has had limited use as a diagnostic tool, due to the apparent lack of primer species-specificity (Langrell, 2002). In order to overcome this problem and to allow faster and more accurate identification of *N. galligena*, a more robust, species-specific PCR detection protocol, based on detailed rDNA ITS analysis was developed by Langrell and co-workers (Langrell and Barbara, 2001; Langrell, 2002).

Neonectria galligena is reported to be present in all regions of the world known for the commercial production of apples and pears (CPC, 2005), which includes South Africa (CMI, 1985). The centre of evolution of this pathogen remains obscure since the disease was not found during recent expeditions to Kazakstan, a region in which wild species of *Malus* are plentiful (CPC, 2005). Official records for the presence of this pathogen in South Africa, dating back to 1917, have been the cause of many disputes during the past years. Doidge made the first reference concerning the presence of European apple canker in South Africa in 1917. Similar information was also published by Doidge *et al.* (1953) and Gorter (1977) regarding the presence of this pathogen in South Africa. However, no notifications of non-compliance (interception of regulated pests) were ever received by the National Plant Protection Organisation (NPPO) of South Africa (Anonymous 2005b), and given the economic importance of this pathogen, *N. galligena* was listed as an A1-regulated pest for South Africa (Anonymous, 2005a). For a pest to be classified as an A1-pest, the pest should be of economic importance to the area endangered thereby, and not yet present there, or present but not widely distributed and being officially controlled (FAO, 2002). The aim of the present study was thus to confirm the presence or absence of *N. galligena* in South African pome fruit orchards by using molecular identification techniques (species-specific PCR), and by a careful re-examination of specimens previously identified as *N. galligena*, and lodged in the National Collection of Fungi (PREM) in Pretoria, South Africa.

MATERIALS AND METHODS

Isolates and specimens. A collection of freeze dried mycelium of 33 putative *Neonectria* isolates were obtained from the Diagnostic Clinic, ARC Infruitec-Nietvoorbij, Stellenbosch. The isolates were obtained from *Malus* spp. from October 1995 to September 1996 (W.A. Smit, pers. comm.). These isolations were made from the samples received from Elgin, Grabouw and Villiersdorp areas, which had typical canker symptoms. Small pieces of tissue were plated directly onto malt extract agar (MEA; Biolab, Midrand, South Africa) and potato dextrose agar (PDA; Biolab, Midrand, South Africa). The plates were incubated at 25°C. Plates were monitored daily for presumptive positive *Cylindrocarpon* isolates, based on general colony characteristics. Hyphae growing from tissue pieces were subcultured onto fresh PDA and water agar (WA; Biolab). Isolates were incubated at 25°C under near-ultraviolet light to induce sporulation. Presumptive positive isolates were hyphal-tipped to obtain pure cultures and maintained on MEA. Freeze-dried mycelium representative of the various strains (Cd. Es 61, Cd. Es.62, Cd. Es.63, Cd. Es. 64, Cd. Es. 93, Cd. Es 96, Cd.o. 1.2, Cd.o.17, Cd.o.18, Cd.o.23, Cd.o.28, Cd.o.32, Cd.o.33.1, Cd.o.34, Cd.o.35, Cd.o.35A, Cd.o.36, Cd.o.37, Cd.o.38, Cd.o.40, Cd.o.42, Cd.o.43, Cd.o.44, Cd.o.45, Cd.o.46, Cd.o.51, Cd.o.56, Cd.o.57, Cd.o.66, Cd.o.69, Cd.o.72, Cd.o.78, Cd.o.79) were submitted in the culture collection of ARC Infruitec-Nietvoorbij's Biotechnology Division.

Herbarium specimens tentatively identified as *N. galligena* and deposited at PREM were re-examined by means of light microscopy. Specimens examined included the following: PREM 6821, PREM 2160, PREM 1908, PREM 1328, PREM 17216a and PREM 28728.

DNA isolation and amplification using species-specific primers for *N. galligena*. The total genomic DNAs from freeze-dried mycelium of 33 presumptive positive isolates were extracted by using the Qiagen® DNeasy® Plant Maxi Kit (Strasse, Hilde, Germany). The species-specific primer pair 5'- AAC CCC TGT GAA CAT ACC CAT C-3' (Ch1) and 5'-GTG GCC GCG CTG CTC TTC CG-3' (Ch2) developed by Langrell (2002) was used in the amplification reaction. The primers were custom synthesised by Integrated DNA Technologies, Inc. (Coralville, IA, USA). The amplification with the species-specific primers for *N. galligena* was performed using PCR conditions recommended by Langrell (2002). DNA of *C. heteronema* were obtained from the Centraalbureau voor Schimmelcultures (CBS), Utrecht, The Netherlands and used as positive controls (CBS 178.58; CBS 303.59), while negative controls, consisting of water instead of template DNA, were also included. PCR products were analysed by electrophoresis at 100 V for 1 h in a 1 % (w/v) agarose gel and visualised under UV light using a Genegenius Gel Documentation and Analysis System (Syngene, Cambridge, United Kingdom) after ethidium bromide staining.

RESULTS

Specimens examined. None of the herbarium specimens tentatively identified as *N. galligena* were representative of this fungus or any other species of *Neonectria*. Specimens were, in fact, representative of the following:

Transvaal, Zoutpansberg, *Pyrus malus*, 23 May 1913, PREM 6821 [= *Gibberella* sp.]; Mpumalanga, Barberton, *Dalbergia armata*, M.E. Doidge, 19 Jan. 1912, PREM 2160 [= *Nectria* sp.]; Gauteng, Pretoria, Wonderboom, on wood of poplar, E.M. Doidge & A.M. Bottomley, 30 Nov. 1936, PREM 28728 [= *Nectria* sp.]; Western Cape Province, Cape Town, roots of poplar, C.P. Lounsbury, 23 Jan. 1907, PREM 1908 [= *Nectria* sp.]; KwaZulu-Natal, Cramond, twrigs of *Acacia* sp., J.B. Pole-Evans, 11 Apr. 1911, PREM 1328 [= *Nectria* sp.]; Eastern Cape Province, Knysna, on *Irene ditricha* on *Cassine papillosa*, E.M. Doidge, 13 May 1923, PREM 17216a [= *Nectria* sp.].

DNA isolation and amplification using species-specific primers for the identification of *N. galligena*. None of the 33 DNA samples of the presumptive positive isolates gave positive results following PCR with the species-specific primers for *N. galligena.* Only DNA from the two positive controls yielded a positive band of 412 bp (Fig. 1).

DISCUSSION

Fungal pathogens responsible for fruit rot can have a very negative effect on South Africa's deciduous fruit industry. This can result from direct losses, as well as market access issues resulting from biosecurity risks posed by the presence of specific pests and diseases. Currently, fruit pathogens are the subject of many quarantine-related market access issues (Beresford, 2005). Phytosanitary decision-making with regard to import conditions for plant material and fresh fruit is solely based on geographical distribution records of pests (Van Halteren, 2000). Moreover, in order to comply with the set of rules as stipulated by the Agreement on Sanitary and Phytosanitary measures as adopted by the World Trade Organization (WTO-SPS) (WTO, 1994, 1996), it is imperative for NPPOs of countries to have access to accurate information regarding the distribution of pests and pathogens within their boundaries. In many countries, including South Africa, the reliability of records of pests is questionable, and many disputes have arisen during the past years about the regulated status of some of South Africa's pests. Some of these records, including the records regarding the presence of European apple canker in South Africa (Doidge, 1917; Doidge *et al.,* 1953; Gorter, 1977) may have resulted from misidentifications, since the necessary taxonomic and identifications skills were not available at that stage.

This study represents the first attempt to resolve the status of *N. galligena* in South Africa by following a molecular approach, which provides a reliable, fast and accurate detection and identification method for this fungus. None of the 33 isolates tested with the species-specific PCR primers gave positive results for *N. galligena*, nor were any of the herbarium specimens lodged at PREM representative of this fungus. The isolates tested were collected from three major apple growing regions in the Western Cape, namely Grabouw, Elgin and Villiersdorp. Results from this study, as well as that of recent studies that failed to identify *N. galligena* from *Malus* spp. in South Africa (Hattingh *et al.,* 1989; Smit *et al.,* 1996, 1997, 1998; Anonymous, 2002), therefore serve as a justification for the current A1-regulated status of *N. galligena* in South Africa. It should, however, be noted that more *Nectria* isolates from these and other *Malus* growing regions are needed to conclusively resolve the status of this pathogen in South Africa.

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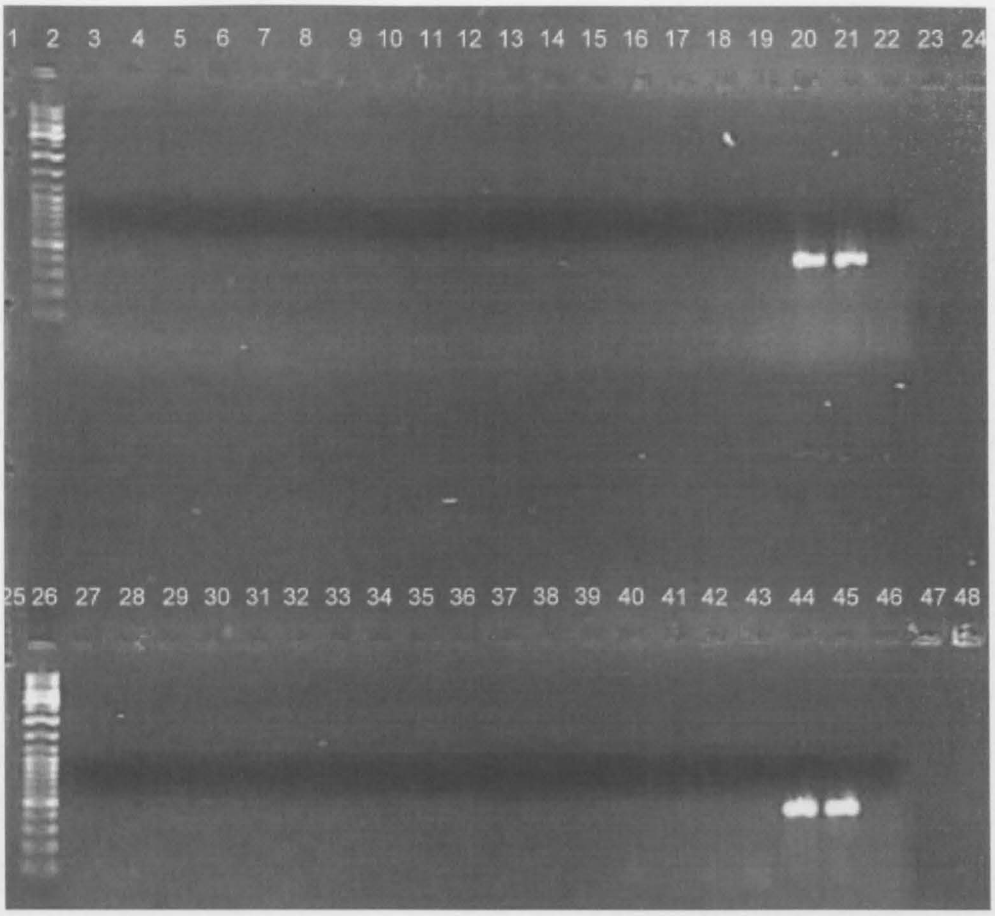

Figure 1. Gel documentation of PCR products following PCR amplification of DNA extracted from *Neonectria* cultures ex *Malus* cultivars with species-specific primers for *N. galligena*. Samples on the gel are as follows: lane 2 denotes a 100-bp DNA ladder; lanes 3 – 19, isolates from *Malus* spp. Isolates in lanes 20 – 21 (CBS 178.58; CBS 303.59) are *N. galligena* positive controls; lane 22 denotes a negative water control; lane 26 denotes a 100-bp DNA ladder; lanes 27 – 42, isolates from *Malus* spp. Isolates in lanes 44 – 45 (CBS 178.58; CBS 303.59) are *N. galligena* positive controls ; lane 46 denotes a negative water control.