# A SURVEY OF SUB-TROPICAL NURSERY PLANTS FOR FUNGAL DISEASES IN NORTHLAND

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## ABSTRACT

During 2003 and 2004 forty-five randomly selected wholesale and retail plant nurseries were surveyed for plant diseases. The plant families *Agavaceae, Annonaceae, Arecaceae, Bromeliaceae, Cycadaceae* and *Musaceae* were targeted. Plants were examined *in situ* for disease symptoms as well as samples being collected for laboratory analyses. Fungi were identified using morphological characteristics, and where necessary with molecular techniques. The survey resulted in a range of fungi being identified from the target plants. These fungi ranged from saprophytes to plant pathogens, some of which may have undesirable effects on New Zealand's biodiversity or economy. Many new host/pathogen records were observed and several fungi were detected for the first time in New Zealand. This paper presents and discusses the results of these findings.

**Keywords:** subtropical, nursery, survey, new records.

## INTRODUCTION

The Ministry of Agriculture and Forestry (MAF) is committed to ongoing plant health surveillance and has conducted comprehensive crop surveys for pests and diseases over a number of years (Dymock & Holder 1996; Braithwaite et al. 1998; Ganev et al. 1999). These surveys targeted specific crops and all pests and disease were identified with an emphasis on detecting existing and new recordings for New Zealand.

The primary aim of the present survey was to identify fungal pathogens associated with ornamental plants from designated families of tropical and subtropical origin grown in Northland. Importation of ornamental plants and foliage has increased in significance and little was known of the disease status of these plants in New Zealand. Hence it was important to survey these plants and determine which diseases were present in New Zealand. The data obtained from these surveys are used to prepare pest lists of existing and new fungal/host associations. This information is used for setting import specifications, which assist with decisions made on plants held in post entry quarantine and facilitate ongoing trade in plants and plant products.

## MATERIALS AND METHODS

The species of plants surveyed and the geographical area covered were determined by MAF Biosecurity New Zealand. Surveyed sites in Northland were selected from lists of wholesale and retail plant nurseries provided by the nursery industry.

A total of forty-five randomly selected sites were surveyed by Investigation and Diagnostic Centre staff during 2003 and 2004. The plant families *Agavaceae, Annonaceae, Arecaceae, Bromeliaceae, Cycadaceae* and *Musaceae* were targeted. At each site all target species were examined for visual disease symptoms, especially foliage

pathogens causing leaf spots and stem cankers as well as diseases causing plant collapse. Infected plant parts (leaves, stems or roots) were collected and placed into individually labelled plastic bags and sealed. A total of 245 diseased plant samples were collected over the two year period. The survey was not based on statistical methods but the examination and sampling of observed disease symptoms. Standard hygiene procedures were carried out at each site to prevent the potential spread of plant pathogens between nursery sites. These included disposable overalls and decontamination of all sampling equipment. All samples were given a unique identification number.

The determination of fungi present was made either directly by microscopic examination or indirectly by isolation to agar culture. Plant tissues showing infection were excised and surface sterilised for 1 min in 1% sodium hyporchlorite, followed by a 1 min wash in sterile water. Small pieces of tissue from the margin of diseased and healthy tissues were plated directly onto prune extract agar and incubated at 20°C±1°C for up to 10 days or until sufficient growth or sporulation enabled identification. Where possible, identifications were carried out to species level. *Fusarium* spp. were identified to species level using molecular techniques, which involved obtaining sequences of the translation elongation factor gene (O'Donnell et al. 1998) and comparing them to authenticated sequences at the internet-based *Fusarium* Database (Geiser et al. 2004). Non-sporulating fungi were identified by comparing sequences of their ITS region (using primers ITS1-F and ITS4) and comparing these to sequences deposited at the GenBank database (White et al. 1990; Gardes & Bruns 1993).

This survey focused on organisms with a primary nature of association, where the organism is able to invade and gain sustenance from intact plant tissues and may cause damage possibility leading to economic loss. Although some saprophytic fungi were identified during this survey, data are not presented here. All new pest associations were entered into MAF's Plant Pest Information Network database (PPIN), which will soon be available on the internet. Any organism new to New Zealand was validated by another practising plant pathologist from New Zealand or overseas. New to New Zealand fungi were investigated further by MAF Biosecurity to determine their distribution and economic impact and whether eradication was feasible.

## RESULTS AND DISCUSSION

Two hundred and forty-five diseased plants were sampled and analysed for plant diseases during the surveys carried out in 2003 and 2004. Eighty-two fungal species were identified representing more than six hundred pest/host associations. Their significance varied from saprophytic fungi with no economic importance through to those that may have undesirable effects on New Zealand biodiversity or affect market access. Significant plant pathogens that affect primary production were also detected.

### New to New Zealand records

Seven fungi, *Coniothyrium concentricum*, *Fusarium phyllophilum*, *F. sterilihyphosum*, *Graphium penicillioides* and three new *Mycosphaerella* spp., (P. Crous & E. Groenewald, pers. comm.) were recorded in New Zealand for the first time (Table 1). *Graphium penicillioides* was considered a saprophytic species of no economic concern. *Coniothyrium concentricum* and *F. phyllophilum* were associated with leaf lesions, predominantly on *Dracaena* and *Sansevieria*, whereas *F. sterilihyphosum* was associated with leaf lesions on Bromiliads. These two *Fusarium* spp. have periodically been identified on imported plant material in post entry quarantine facilities in New Zealand. Knowledge that these fungi are now established in New Zealand has implications in the setting of plant importation standards. MAF Biosecurity New Zealand has now determined that these *Fusarium* spp. are present and widely distributed throughout the Northland region. The significance of the three *Mycosphaerella* spp. is uncertain. Direct sequencing of the ITS regions of their ribosomal DNA did not specifically match any sequences on GenBank or at the Centraalbureau voor Schimmelcultures (CBS) databases. Although the isolates do cluster within *Mycosphaerella,* they are likely to be new or undescribed species. Additional work will be conducted at CBS. Their nature of

association has not been determined and since they were isolated from potentially dead tissues they may either be endophytic or pathogenic.

**TABLE 1: New host recordings for fungi identified for the first time in New Zealand during the 2003 and 2004 surveys.**

| Pest organism | Host |
|---|---|
| *Coniothyrium concentricum*[1] | *Agave* sp., *Beaucarnea recurvata, Dracaena* sp., *Dracaena draco, Rhopalostylis* sp., *Sansevieria* sp., *Trachycarpus fortunei, Yucca* sp. |
| *Fusarium phyllophilum*[2] | *Dioon spinulosum, Dracaena* sp., *Dracaena draco, Sansevieria trifasciata* |
| *Fusarium sterilihyphosum*[2] | *Aechmea luddemanniana, Alcantarea imperialis, Dyckia* sp., *Neoregelia* sp., *Nidularium amazonicum* |
| *Graphium penicillioides*[1] | *Annona cherimola* |
| *Mycosphaerella sp. A*[3] | *Bromelia sp., Guzmania sp.* |
| *Mycosphaerella sp. B*[3] | *Vriesea sp.* |
| *Mycosphaerella sp. C*[3] | *Aechmea fulgens, Chrysalidocarpus lutescens, Cordyline baueri, Dracaena draco, Guzmania* sp. |

[1]Identified by morphological characteristics.
[2]Identified by DNA direct sequencing and morphological characteristics.
[3]Identified by DNA direct sequencing.

**New primary and secondary pest/host associations**

Thirty-five fungi determined as primary pathogens and representing new pest/host associations for New Zealand were identified during the 2003 and 2004 surveys (Table 2). In this survey, *Glomerella cingulata* and *Colletotrichum acutatum* were the most commonly isolated fungi, usually associated with leaf spots on the various hosts. These fungi are widespread in New Zealand, commonly associated with leaf spots and fruit rots. Eight *Fusarium* spp. (including the two new to New Zealand species) were also detected during this survey. *Fusarium* spp. are relatively common in New Zealand on a wide range of hosts where they mostly cause root rots (Braithwaite et al. 1998). Many *Fusarium* spp. are economic pests. However, in this survey they were most commonly cultured from leaf lesions. The other primary and secondary fungi cultured were mostly minor, leaf-spotting organisms. These fungi commonly occur on a wide range of hosts in New Zealand. This list of pest/host associations provides valuable information on the fungi associated with these hosts in New Zealand.

**General Discussion**

The detection of economically important exotic fungi incursions mostly relies on passive sample submission from the public and limited planned surveillance. The identification of seven fungi new to New Zealand from this survey, some of which may have been present but undetected for some time, and the significant number of new host associations emphasised the importance of conducting these types of surveys.

During this survey, many new host records were observed for fungi previously recorded in New Zealand. This commonly occurs during disease surveys of this type (Dymock & Holder 1996). Little was known about the disease status of these targeted and mostly imported nursery plants.

**TABLE 2: New primary and secondary pest/host associations recorded during the 2003 and 2004 surveys.**

| Pest organism | Host |
|---|---|
| *Botryosphaeria dothidea* | *Annona cheromila* |
| *Botryosphaeria parva* | *Agave attenvata, Phormium sp., Sansevieria* sp., *Solanum muricatum* |
| *Botyrtis cinerea* | *Aechmea luddemanniana, Chamaedorea elegans, Dracaena* sp., *Musa* sp.,*Neoregelia* sp., *Psidium guajava, Strelitzia reginae, Vriesea platynema, Yucca elephantipes* |
| *Calonectria pauciramosa* | *Callistemon viminalis* |
| *Cercospora apii* | *Archontophoenix* sp. |
| *Cochliobolus cynodontis* | *Dypsis baronii, Syagrus romanzoffiana* |
| *Colletotrichum acutatum* | *Annona cherimola, Archontophoenix* sp., *Butia capitata, Chamaedorea elegans, Chrysalidocarpus lutescens, Doryanthes palmeri, Jubaea chilensis, Musa* sp., *Psidium guajava, Solanum muricatum* |
| *Colletotrichum capsici* | *Bromelia* sp., *Yucca* sp. |
| *Colletotrichum crassipes* | *Vriesea* sp. |
| *Curvularia lunata* | *Chrysalidocarpus lutescens* |
| *Fusarium anthophilum* | *Chrysalidocarpus lutescens* |
| *Fusarium compactum* | *Agave attenuata* |
| *Fusarium oxysporum* | *Beaucarnea recurvata, Cordyline baueri, Dracaena draco, Phormium* sp., *Sansevieria* sp. |
| *Fusarium sambucinum* | *Musa sp., Rhopalostylis cheesemanii* |
| *Fusarium sporotrichioides* | *Archontophoenix* sp., *Musa* sp., *Strelitzia reginae, Yucca* sp. |
| *Fusarium tricinctum* | *Agave attenuata* |
| *Fusicoccum luteum* | *Clivia miniota* |
| *Gibberella acuminata* | *Cycas* sp., *Musa* sp., *Yucca elephantipes* |
| *Gibberella baccata* | *Cycas* sp., *Musa* sp., *Yucca elephantipes* |
| *Gibberella intricans* | *Beaucarnea recurvata, Musa sp.* |
| *Gibberella zeae* | *Brahea* sp., *Chamaerops humilis, Musa acuminate, Olea europaea, Phoenix canariensis, Rhopalostylis cheesemanii, Yucca elephantipes, Yucca filamentosa* |
| *Glomerella cingulata* | *Agave* sp., *Aloe* sp., *Archontophoenix alexandrae, Archontophoenix* sp., *Brahea armata, Bromelia* sp., *Cordyline australis, Cycas kennedyana, Cycas revolute, Dioon spinulosum, Dracaena draco, Dracaena hookeriana, Dypsis baronii, Howea forsteriana, Jubaea chilensis, Livistona decipiens, Meryta sinclairii, Musa acuminate, Neodypsis decaryi, Neoregelia* sp., *Nidularium innocentii, Phoenix canariensis, Phoenix roebelinii, Phormium tenax, Psidium cattleianum, Psidium guajava, Ravenea rivularis, Rhopalostylis baueri, Solanum muricatum, Washingtonia robusta, Yucca elephantipes, Yucca filamentosa* |
| *Microsphaeropsis olivacea* | *Dracaena hookeriana, Psidium guajava* |
| *Nectria haematococca* | *Dracaena* sp. |
| *Pestalotiopsis versicolor* | *Archontophoenix cunninghamiana, Bromelia* sp., *Caryota* sp., *Cycas* sp., *Dracaena draco, Dyckia* sp., *Hyophorbe verschaffeltii, Lepidozamia peroffskyana, Musa* sp., *Olea europaea, Phoenix canariensis, Phoenix roebelinii, Rhapis excelsa, Rhopalostylis cheesemanii, Rhopalostylis sapida, Roystonea* sp., *Strelitzia nicolai, Syagrus romanzoffiana, Washingtonia robusta* |
| *Phoma exigua* | *Annona cherimola, Monstera* sp., *Solanum muricatum* |
| *Phoma glomerata* | *Archontophoenix cunninghamiana, Guzmania* sp., *Ravenea rivularis, Vriesea hieroglyphica, Yucca* sp. |
| *Phoma macrostoma* | *Archontophoenix cunninghamiana, Musa x paradisiaca, Solanum muricatum* |
| *Phoma nigricans* | *Strelitzia* sp. |
| *Phoma plurivora* | *Yucca* sp. |
| *Phoma pomorum* | *Astelia* sp. |
| *Phyllosticta* sp. | *Roystonea* sp. |
| *Pseudocercospora* sp. | *Rhopalostylis cheesemanii, Rhopalostylis sapida* |
| *Thanatephorus cucumeris* | *Strelitzia nicolai* |

These lists of pest/host associations did highlight the most common fungi on these surveyed hosts in New Zealand. This information will be useful for the preparation of pest lists used in setting import specifications and providing up to date pest lists for exporters. It is also a valuable resource in setting priorities in disease management and related research in ornamental horticulture.

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