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IDENTIFICATION OF PLANT PATHOGENS ASSOCIATED WITH FOLIAGE NURSERIES

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ABSTRACT

Foliage industry is becoming popular in Sri Lanka supplying plants for both foreign and local markets. One of its associated problems is the rejection of consignments due to the occurrence of pests and diseases. Diseases found in foliage nurseries were surveyed during January 2001 to January 2002 in Gampaha and Kurunegala districts. The survey revealed that the disease management was not properly executed by the growers. Fungal problems detected in association with leaf lesions included: *Alternaria, Colletotrichum, Curvularia, Fusarium, Pestalotia, Gloeosporium, Cercospora, Myrothecium,* and *Acremonium*. The fungi associated with collar rot and root rot included: *Fusarium* spp., *Phytophthora* spp., *Rhizoctonia solani, Sclerotium rolfsii,* and *Pythium* spp. Some nurseries had bacterial diseases caused by *Erwinia* spp. and *Xanthomonas* spp.

KEY WORDS: *Alternaria, Colletotrichum,* Export, Foliage, Fungal Diseases, Plant Nurseries, *Sclerotium rolfsii.*

INTRODUCTION

At present, growing flowers and foliage plants have developed into a major agro industry in Sri Lanka. According to the export statistics, total export earnings from flowers and foliage plants during year 2000 is about Rs 625 million (Anon, 2000). Forty-four countries, mainly western European countries and Japan have obtained our produce. Even though this industry in Sri Lanka has a short history, a remarkable progress has been made in the production of high quality ornamental plants with international standards. Export oriented floriculture consists of cut flowers, cut foliage, live plants, propagatory materials and dried floriculture products. There has been a steady increase in the production of tropical foliage plants for export in Sri Lanka due to country's bio climatic variations, biodiversity and plant endemicity, higher land and labor availability *etc.* Along with all these potentials, government assistance and incentives have positively contributed to the growth of the industry within a short period of time.

In Sri Lanka, up to 1999, around 350 ha were under commercial cultivation of floriculture plants (D.S.A. Wijesundara, unpublished). Around 116 nurseries were engaged in the production of export oriented floriculture products. Since the export market distinctly looks for the quality of the material, foliage plants should be free from all kinds of pathogens and diseases. Various literature have documented diseases of foliage and ornamental plants (Chase and Brosch, 1993; Chase, 1989; Kudagamage *et al.*1998; Moorman, 1998; Strider, 1985). Any detection of undesirable

organisms may lead the foreign buyers refusal of the plants and also black listing of the suppliers. The National Plant Quarantine Service took initiative to guide exporters how to identify diseases and improve the health status of their nurseries. The objective of this investigation was to generate information about some foliage plant diseases and their identification methodology.

MATERIALS AND METHODS

Sampling

A field survey was conducted during January-July 2001 in seven foliage farms, Asian Cutting, Tropical Foliage, Ita Lanka, Ramya Horticulture, Serendib, Green Farms and Mike Flora. Leaves and infected plants were collected from the nurseries for laboratory investigation.

Laboratory Investigation

Visual observation: Collected samples were examined under stereoscopic microscope for their symptom characters.

Humid chamber method: Advancing edges of lesions from samples were kept in a moist chamber at room temperature (25^0 C±2) under normal daylight conditions for one week. Any organism found growing were observed under the microscope for their growth characteristics and sporulating structures.

Agar figure method: The pathogens were cultured on potato dextrose agar (PDA), nutrient agar (NA), and potato semi-synthesis dextrose agar (PSSDA) media. The fungal colonies were identified according to their colony and morphological characters. Physiological and biochemical tests were used to distinguish bacterial colonies as given in Schaad (1988).

RESULTS AND DISCUSSION

The nurserymen were cultivating a large quantities of a few plant species. A few diseases were found to affect the plants (Table 1). More diseases appeared when more plant species were grown. Also, fungi were more prevalent than other pathogenic agents (Figures 1-9). Several physiological disorders were also seen affecting the plants (Figure 3). These were mostly nutrient deficiencies.

Table 1. Disease status in foliage plant nurseries

Nursery	*No. of Cultivated Species*	*No. of Pathogens*
Asian Cuttings (Pvt.) Ltd., Katana	9	7
Green Farms (Pvt.) Ltd., Marawila	6	5
Ita-Lanka Foliage (Pvt.) Ltd., Attiyawala	8	7
Mike Flora (Pvt.) Ltd., Rambukkana	8	5
Ramya Horticulture (Pvt.) Ltd., Walpita	7	6
Serandib Foliage (pvt.) Ltd., Kalagedihena	6	3
Tropical Foliage (Pvt.) Ltd., Badalgama	17	10

In Asian Cuttings nursery (Table 2), *Aglaonema* plants had *Erwinia* (Figure 1) and *Colletotrichum* (Figure 2) infections while other plants had only one pathogen. *Adenium obesum*, *Hosta*, and *Livistonia* were relatively free of pathogens but showed physiological disorders. Diseases due to *Fusarium* and *Sclerotium* were prominent. Bacterial infection in *P. vitichy* could not be identified.

Table 2. Pathogens found in Asian Cuttings Nursery

Pathogen	*Hosts*
Colletotrichum	*Aglaonema*
Cladosporium	*Bambusa vulgaris*
Erwinia	*Aglaonema*
Fusarium	*Miscanthes*
Phoma	*Cordyline,*
Sclerotium	*Chlorophytum comosum*

Plants in Green Farms nursery were infected with five different pathogens (Table 3). Among them, *Rhizoctonia* was found in *Codiaeum*, *Dracaena* and *Ixora*, while *Colletotrichum* infected both *Codiaeum* and *Polyscias*.

Table 3. Pathogens found in Green Farms nursery

Pathogen	*Hosts*
Colletotrichum	*Codiaeum variegatum*
	Polyscias
Fusarium	*Dracaena godseffiana*
Phytophthora	*Dracaena marginata*
Rhizoctonia	*Codiaeum variegatum*
	Dracaena godseffiana
	Ixora
Xanthomonas	*Dracaena sanderiana*

Plants in Ita-Lanka nursery were infected with six different fungi (Table 4). *Phoma* species were found in two plant species. *Polycias* had shown bacterial infections that could not be identified. Dracaena marginata were heavily infected with *Pestalotia* sp. (Figure 9).

Table 4. Pathogens found in Ita-Lanka Nursery

Pathogen	*Hosts*
Alternaria	*Livistonia chinensis*
Colletotrichum	*Codiaeum variegatum*
Fusarium	*Dracaena deremensis*
Pestalotia	*Dracaena marginata*
Phoma	*Cordyline*
	Dracaena sanderiana
Sclerotium	*Chlorophytum comosum*

Four fungi and one bacterium infected the plants in Mike Flora nursery (Table 5). *D. sanderiana* had two pathogens, a fungus and a bacterium. Except *Aspergillus* (Figure 6), other three fungi had two hosts each.

Table 5. Pathogens found in Mike Flora Nursery

Pathogen	*Hosts*
Alternaria	*Calathea bella*
	Polycias
Aspergillus	*Dracaena*
Colletotrichum	*Dracaena sanderiana*
	Livistonia chinensis
Sclerotium	*Chlorophytum comosum*
	Chlorophytum varigatum
Xanthomonas	*Dracaena sanderiana*

Five fungi and one bacterium were found in plants of Ramya Horticulture nursery (Table 6) where *Alternaria* were detected in three hosts.

Table 6. Pathogens found in Ramya Horticulture Nursery

Pathogen	*Hosts*
Alternaria	*Calathea*
	Cantioffcees
Alternaria tenuis	*Livistonia chinensis*
Colletotrichum	*Miscanthus*
Erwinia	*Aglaonema*
Fusarium	*Dracaena sanderiana*
Pestalotia	*Cordyline*

Two fungi and one bacterium were found in plants of Serendib Foliage nursery (Table 7). *Colletotrichum* infected three hosts while *Fusarium* (Figures 4 and 7) were found in four hosts. *Aglaonema* plants had *Erwinia* and *Colletotrichum* infections. *D. sanderiana* had infections of the two fungi. Plants in Tropical Foliage nursery had the most number of diseases caused by eight fungi and two bacteria (Table 8). *Alternaria* and *Rhizoctonia* (Figure 8) were found in three hosts each, whereas *Erwinia* and *Xanthomonas* were in two hosts. Four hosts were affected by *Fusarium*. *Aglaonema* plants were infected with three pathogens whereas *Dracaena* plants had four pathogens.

Table 7. Pathogens found in Serendib Foliage Nursery

Pathogen	*Hosts*
Colletotrichum	*Aglaonema*
	Dracaena sanderiana
	Miscanthus
Erwinia	*Aglaonema*
Fusarium	*Dracaena godseffiana*
	Dracaena marginata
	Dracaena sanderiana
	Polycias balforiana

Table 8. Pathogens found in Tropical Foliage Nursery

Pathogen	*Hosts*
Alternaria	*Dracaena glauca*
	Polycias crispum
	Schefflera
Aspergillus	*Dracaena*
Colletotrichum	*Aglaonema*
Erwinia	*Aglaonema*
	Dracaena marginata
Fusarium	*Aglaonema*
	Dracaena marginata
	Gardinia jasminosa
	Polycias
Phoma	*Gardinia jasminosa*
Pythium	*Scindapsus aures*
Rhizoctonia	*Chlorophytum*
	Philodendron
	Scindapsus aures
Sclerotium	*Crossandra*
Xanthomonas	*Dracaena sanderiana*
	Philodendron

Colletotrichum was detected in all nurseries surveyed whereas *Cladosporium* (in Asian Cuttings), *Phytophthora* (Green Farms) and *Pestalotia* (Ita-Lanka) had restricted distribution (Table 9). *Fusarium* was not detected in Mike Flora nursery.

Table 9. Distribution of pathogens in seven nurseries

Pathogen	*Number of nurseries*
Alternaria	4
Aspergillus	2
Cladosporium	1
Colletotrichum	7 (all)
Erwinia	4
Fusarium	6
Pestalotia	1
Phoma	3
Phytophthora	1
Rhizoctonia	2
Sclerotium	4
Xanthomonas	3

The survey revealed that the soil moisture and high temperatures had favoured the disease incidence. The incidence of diseases such as collar rots and root rots could be controlled by sterilized soil and by chemical fumigation at planting. The observed diseases are mostly cosmetic and distributed worldwide (Chase & Brosch, 1993). However, presence of these pathogens would degrade the quality and thus the market value of the plants.

Nurserymen were advised to practice proper disease management procedures. A manual was prepared as a guide to identify the diseases (Annex 1). The correct identification would help to select the proper control strategy. Farm demonstrations, workshops and other awareness programs were conducted while recommending suitable measures to prevent the outbreak of diseases. Biological control of soil borne diseases is considered a challenging goal and has been the focus for research over many years. It offers durable safe and cost effective alternatives to pesticides. (Chet, 1987 and Hornby, 1990).

CONCLUSION

To obtain a better price, growers have to fulfill quality and pest free condition to their products. Use of pathogen free planting material and soil to raise the plants are essential in ommercial cultivation. Therefore, adaptation of integrated disease control programme with an awareness of the factors that affect out-break of diseases was very important. The prepared guide would be helpful for the nurserymen in disease identification.

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Figure 1. *Erwinia* **on leaves of** *Aglaonema* **spp.**

Figure 3. Physiological disorders of leaves of *Acreca catechu*

Figure 5. *Erwinia* **in** *Draceana marginata*

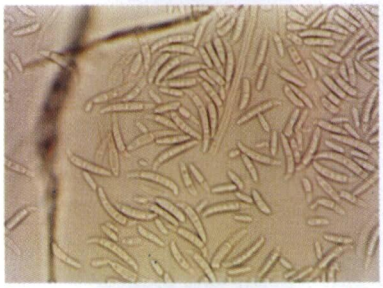


Figure 7. Macro and micro conidia of *Fusarium* **spp.**

Figure 9. Conidia of *Pestalotia* **spp.**

Figure 2. Conidia of *Colletotrichum* **spp.**

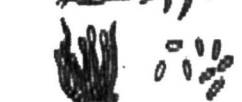
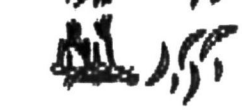
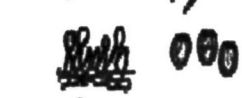
Figure 4. *Fusarium* **infection in** *Dracaena*

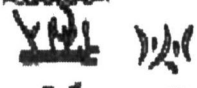
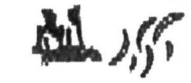
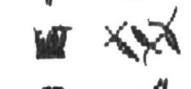
Figure 6. *Aspergillus* **leaf and stem rot on** *Dracaena* **purple compacta**

Figure 8. *Rhizoctonia* **leaf blight on** *Scindapsus aurieus*

Annex 1. Guide for Disease Identification

Name of plant	Disease symptoms	Pathogen	Morphological characters a-Conidiophore b-Conidia/Spore
1. *Aglaonema*	i. Circular necroticspot with yellow halo	a. *Acremonium* spp.	
		b. *Drechslera* spp.	
		c. *Myrothecium verrucaria*	
	ii. Stem and root rot	a. *Fusarium solani*	
		b. *Phytophthora* sp.	
2. *Codiaeum*	i. Necrotic spots and necrosis of leaf tips	a. *Gloeosporium frutigenum*	
		b. *Glomerella cingulate*	
3. *Cordyline*	i. Leaf tip necrosis and necrotic spots with a halo within the lamina	a. *Alternaria tenuis*	
		b. *Alternaria longissima*	
		c. *Cercospora* sp.	
4. *Dieffenbachia*	i. Small circular brown spots with yellow halo margin	a. *Acremonium* sp.	
		b. *Myrothecium roridum*	
		c. *Phyllosticta* sp.	
5. *Dracaena glauca*	i. Necrotic spots with white papery centre	a. *Alternaria tenuis*	
		b. *Curvularia pallascens*	
	ii. Blight	a. *Fusarium verticilloides*	
		b. *Sclerotioum rolfsii*	
6. *Dracaena godseffiana* "Florida beauty"	i. Leaf tip necrosis and necrotic sectors within in the lamina	a. *Colletotrichum* sp.	
		b. *Fusarium pallidorosum*	
		c. *Fusarium verticilloides*	

		d. *Colletotrichum* sp.	
		e. *Curvularia* sp.	
		f. *Cylindrocarpon* sp.	
		g. *Pestalotiopsis* sp.	
	ii. Stem rot, root rot, foliage blight	a. *Fusarium pallidosorum*	
		b. *Fusarium solani*	
7. *Dracaena marginata*	i. Flecking and irregular reddish Brown spots	a. *Fusarium verticilloides*	
8. *Dracaena reflexa* "Song of India"	i. Irregular necrotic spots with reddish brown margin	a. *Colletotrichum dermatium*	
		b. *Fusarium verticillodes*	
		c. *Fusarium pallidorosum*	
9. Dracaena sanderiana "white"	i. Irregular necrotic spots with margin	a. *Botrytis cineria*	
	ii Large necrotic spots with reddish brown margin	a. *Alternaria tenuis*	
		b. *Fusarium Pallidosorum*	
		c. *Fusarium verticilloides*	
		d. *Lasiodiplodia theobromae*	
		e. *Myrothecium roridum*	
		f. *Stemphylium* sp.	

10. *Dracaena* sanderiana "Gold"	i. Irregular necritic spots with whitish centre	**a.** *Colletotrichum dermatium*	
		b. *Colletotrichum* sp.	
		c. *Fusarium oxysporium*	
		d. *Fusarium* verticilloides	
		e. *Myrothecium verrucaria*	
		f. *Pestalotia* sp.	
		g. *Phoma* sp.	
		h. *Pyrenochaeta* sp.	
11. *Livistonia*	i. Elliptical necrotic spots, front tip necrosis	**a.** *Alternaria tenuis*	
		b. *Curvularia* sp.	
		c. *Drechslera incurvata*	
		d. *Drechslera rostrata*	
12. *Philodendron*	i. Leaf blight	**a.** *Rhizoctonia solani*	
13. *Dracaena* "Purple compecta"	i. Leaf blight	**a.** *Aspergillus niger*	
14. *Cholorophytem*	i. Softbrown decay on laves and roots	**a.** *Sclerotium rolfsii*	
15. Roses	i. Leaf and blossom blight	**a.** *Botrytis cinerea*	
	ii. Powdery mildew	**a.** *Sphaerotheca pannosa*	
	iii. Dowony mildew	**a.** *Pseudoperonospera* sp.	
	iv. Black spot	**a.** *Marsonnosa*	

Bacterial diseases

16. *Anthurium*	i. Leaf blight	**a.** *Xanthomonas campestris* pv. *Dieffenbachiae*
17. *Scindapsis*	i. Soft rot	**a.** *Erwinia* sp.
18. *Aglaonema* spp.	i. Soft rot	**a.** *Erwinia* sp.