

UNRECORDED FUNGAL DISEASES AFFECTING ORNAMENTAL PALMS IN EGYPT: I- SURVEY, SYMPTOMS, ISOLATION AND IDENTIFICATION OF THE ASSOCIATED FUNGI

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(Manuscript received 26 November 2001)

Abstract

Disease survey was carried out for the first time in Egypt (1996-2000) in five governorates in order to search for fungal diseases of 18 palm species, grown in nurseries and /or landscape. Data indicated that there are eight fungal diseases which varied in their importance. Damping-off, root and / or basal stem rot as well as leaf spots were the most serious and prevalent diseases in nursery. Pink rot (*Gliocladium vermoseni*), leaf spots caused by several fungal pathogens and black scorch (*Thielaviopsis paradoxa*) were the major disease problems on landscape palms. Whereas, Fusarium wilt (*F. oxysporum*), inflorescence rot or Khamadj disease (*Mauginiella scaettae*) and Botryodiplodia rot (*B. theobromae*) were the minor diseases on landscape palms. According to the available literature, the recorded diseases are unknown fungal problems on ornamental palms in Egypt before our survey trials.

Each of the five prevalent diseases in nursery and landscape was recorded on several ornamental palms, whereas the minor ones Fusarium wilt (*Archontophoenix alexandrae* & *Phoenix canariensis*), Khamadj disease (*Roystonea regia*) and Botryodiplodia rot (*Pritchardia pacifica*, *R.regia* and *Sabal palmetto*) were only found on the referred palms. The highest numbers of the diseases were recorded on *A. alexandrae* and *R.regia*, while the least on *Barahea armata* and *S. palmetto*. On the other hand, fungi associated with each disease were tabulated and general or distinct symptoms were fully described and photographed.

INTRODUCTION

Palms are popular ornamental plants with graceful, tropical and majestic appearance. They are valued because of their variability, durability and adaptability to a wide range of different situations (Forsberg, 1987). The most common disease problems on foliage plants are soilborne and aerial diseases (Cline *et al.*, 1988). These diseases are, however, serious and destructive in palm production in nurseries to (Knauss *et al.*, 1981 & Forsberg, 1987), where shady, humid and crowded conditions provide an ideal environment for their development and spread. Besides, high susceptibility of the young succulent tissues to pathogen attack, with resistance or tolerance to infection increasing usually with host plant maturity are often occurred (Knauss, 1981). The

most aggressive root rot fungi on palms are *Fusarium* spp., *Phytophthora* spp., *Pythium* spp. and *Rhizoctonia solani* (Knauss, 1974 & 1975; Knauss *et al.*, 1981; Alfieri *et al.*, 1984; Chase, 1992 and Belessington & Collins, 1993). Stem and bud rots (*Gliocladium vermoeseni*, *Phytophthora* spp. & *Thielaviopsis paradoxa*), leaf spots (*Alternaria* spp., *Cercospora* spp., *Colletotrichum* spp., *Cylindrocladium* spp., *Fusarium* spp. and *Helminthosporium*-like organisms) are the most frequent foliar diseases (Wehlburg *et al.*, 1975; Chase, 1982; Forsberg, 1985 & 1987; Farr *et al.*, 1989; Chase & Broschat, 1993; Meerow, 1994 and Stewart, 1994).

In Egypt, the improvement in economic standard in recent years, the expansion in new towns and villages establishment all over the country and the favorable environmental conditions for growth and culture, ornamental palms have become important economic commodity. Therefore, seeds of many new palms species were introduced from several countries for planting and this situation greatly increased the occurrence of disease problems. Unfortunately, losses in stand of ornamental palms were not taken into consideration and studies concerning diseases of these plants were negligible. According to the available literature, study of Abdel-Kader and Morsy (1998) on leaf base rot (*Mauginiella scaettae*) of *Roystonea regia* was the sole investigation on ornamental palms in Egypt. Therefore, this survey was conducted in five governorates during five successive years (1996-2000) in order to define for the palm fungal diseases and identify their causal agents. Definite or general symptoms were also described and photographed.

MATERIALS AND METHODS

I- Disease survey:

During five successive years (1996-2000), seedlings or mature nursery or landscape ornamental palms decline occurring in Cairo, Giza, Qalubya, Sharkyia, Damietta governorates were examined for associated fungal diseases. Palms inspection was continuously performed in the first three governorates during the survey trials, whereas it was made three times in the last two governorates. Fungal diseases was recorded and symptoms of each were fully described and photographed. Samples from the diseased plant tissues were always collected from the 18 species of palms under observation (Table 1) to be used in laboratory examination and isolation.

II- Isolation and identification of the associated fungi:

Isolation was made from infected tissues of the roots, stems, buds, leaves and inflorescences. Tissues were washed several times in running tap water and finally with distilled water. These tissues were cut in 5-mm cubes or pieces 5 mm in length. The washed tissues were surface sterilized in 3% sodium hypochlorite solution and rinsed with five changes of sterilized deionized water (SDW), dried with sterile filter paper,

and placed onto DA and V-8 juice media (Miller, 1955). Plates were incubated in the dark for seven days at $25\pm 3^{\circ}\text{C}$. The isolated fungi were purified using single spore or hyphal tip techniques. They were identified according to Commonwealth Mycological Institute description of pathogenic fungi and bacteria, and kindly confirmed by the Department & Mycology and disease survey, Plant Pathology Research Institute, ARC, Egypt.

III- Disease symptoms:

Symptoms of the recorded diseases encountered in nursery and/or landscape were fully described and photographed.

RESULTS AND DISCUSSION

1- Disease survey:

Data presented in Table (1) show that damping-off, root and /or basal stem rots as well as leaf spots on palms were the most serious and prevalent diseases in the nurseries examined. Pink rot was also a destructive disease only on *Chamaedorea* spp. in nursery. On the other hand, pink rot, leaf spots and black scorch were the major disease problems on landscape palms. The highest number (10) of fungal diseases was recorded on *Roystonea regia*, followed by *Archontophoenix alexandrae* (6) and *Howea forsteriana* (6), while the least number was on *Barahea armata* (2) and *Sabal palmetto* (2).

Pink rot symptoms were noticeable on stems, leaves and / or buds of 12 palm species, while all these symptoms were only noted on *Archontophoenix alexandrae*, *Howea forsteriana* and *Roystonea regia*. Stems of only two palms (*Pritchardia pacifica* & *Roystonea regia*) exhibited Thielaviopsis rot symptoms, whereas 12 species of palm were found to be infected with black scorch disease. As for leaf spots, all species tested, except *Pritchardia pacifica* and *Sabal palmetto* were infected. Fusarium wilt was found on *Archontophoenix alexandrae*, *Phoenix canariensis*, inflorescence rots on *Chamaedorea elegans*, *C.seifrizii* or Khamadj *Roystonia regia* and Botryodiplodia rot on *Pritchardia Pacifica*, *Roystonia regia* & *Sabal palmetto* were minor diseases on landscape palms, although they were very serious if present.

Data on damping-off and root rots incidence indicate that these diseases were found on most palms examined in nurseries. The same prevalence of diseases was also found with leaf spots in both nursery and landscape plants. In this respect, Chase and Broschat (1993) stated that damping-off diseases have wide host ranges and all palms produced from seeds are subject to infection. Also, Forsberg (1987) reported that foliar diseases including leaf spots are a common and serious problem in ornamental palm production, especially under nursery environmental conditions. He also stated that root

rots occurred on many palm species. On the other hand, pink rot which was found to be a major disease problem in Egypt, was previously reported on different species of *Chamaedorea* and *Chrysalidocarpus lutescens* (Reynolds, 1964 and Keim & Maire, 1975). Moreover, it is a serious problem in California where it was involved in the death of street plants of *Phoenix* palms (Feather *et al.*, 1979). Many genera and species of palms, including most of the palms included in the present work, were infected with pink rot in the greenhouse and landscape (Chase & Broschat, 1993). Thielaviopsis disease is also a common problem in several countries of the world (Chase & Broschat, 1993). Moreover, the fungus is able to infect different species of palms causing distinguishable symptoms including black scorch and stem rots (Alfieri *et al.*, 1984 and French, 1987).

Fusarium wilt (Feather *et al.*, 1979 & 1989 and Plyler *et al.*, 1999), Botryodiplodia rot (Lele *et al.*, 1980) were also reported on ornamental palms.

Inflorescence rot (Khamadj disease) was reported only on date palm in Egypt (Badawy & Abdel-Al, 1982), however, the causal pathogen of this disease (*Mauginiella scaettae*) was found to cause leaf base rot disease on *Roystonea regia* (Abdel-Kader & Morsy, 1998).

II- Isolation and identification of the associated fungi :

Data illustrated in Table (2) indicate that 13 and 17 fungal species were isolated from damping-off and root and/or basal stem rots diseased tissues, respectively, of 18 palm species examined. Fungi resulting in damping-off symptoms were: *Alternaria alternata*, *Aspergillus niger*, *Botryodiplodia theobromae*, *Cladosporium* sp., *Fusarium moniliforme*, *F. oxysporum*, *Helminthosporium* sp., *Penicillium roseum*, *Phytophthora parasitica*, *Pythium splendens*, *Rhizopus nigricans*, *Thielaviopsis paradoxa* and *Trichoderma viride*. However, fungi of root and/or basal stem rots were *A. alternata*, *B. theobromae*, *Curvularia lunata*, *F. equiseti*, *F. moniliforme*, *F. oxysporum*, *Penicillium roseum*, *F. semitectum*, *F. solani*, *Gliocladium vermoesenii*, *Macrophomina phaseolina*, *Nigrospora sphaerica*, *Phytophthora parasitica*, *Pythium splendens*, *Rhizoctonia solani*, *Stemphylium* sp. and *Thielaviopsis paradoxa*. All the infected tissues of the palm species tested yielded 4-9 fungi/species in isolation trials. However, the most frequent fungi were: *A. alternata*, *F. solani*, *Pythium splendens* and *R. solani*, followed by *F. oxysporum* and *T. viride*. They were isolated from 10, 10, 13, 14, 8 and 6 palm species, respectively.

Our results concerning the most frequent fungi of damping-off were somewhat similar to those reported by Chase (1988 & 1993). She reported that species of *Fusarium*, *Phytophthora*, *Pythium* and *Rhizoctonia* are the most common fungi causing damping-off and are frequently found affecting many palm species in nurseries. As for root and/or basal stem rots, Schulman (1971), Knauss (1974 & 1975), and Alfieri *et al.*

Table 1: Occurrence of fungal diseases on 18 species of ornamental palms, grown in five governorates in Egypt, during five successive seasons (1996-2000).

No	Palms: Latin&common names*	(1) Damping- Off	-1 Root(A) and/or basal stem	-3		-2		-3 Leaf spots	-2 Fusarium wilt	-2 inflorescence rots or khamadj disease	-2	
				Pink rots on:		Thielaviopsis disease as:					Botryodiplodia rot on:	
				Leaves& buds	Stems	Black scorch	Stem rot				Bud	Stem
1	<i>Archontophoenix alexandrae</i> (Seaforthia elegans)	XX	A&B	+	+	+	-	+	+	-	XX	XX
2	<i>Barthea amata</i> (Mexican blue palm)	+	A&B	-	-	-	-	XX	-	XX	XX	XX
3	<i>Caryota mitis</i> (Clustering fishtail palm)	+	A&B	+	-	-	-	+	-	-	-	-
4	<i>Chamaedorea elegans</i> (Parlor palm)	+	A	-	+	-	-	+	-	-	-	-
5	<i>C. seifrizii</i> (Bambo palm)	+	A	-	+	-	-	+	-	-	-	-
6	<i>Chamaerops humilis</i> (European fan palm)	+	A	+	-	-	-	+	-	-	-	-
7	<i>Chrysalidocarpus lutescens</i> (Areca palm)	+	B	-	+	+	-	+	-	-	-	-
8	<i>Howea forsteriana</i> (Kentia palm)	+	A&B	+	+	+	-	+	-	-	-	-
9	<i>Hyphorbe lagenicaulis</i> (Bottle palm)	+	B	-	-	-	-	+	-	-	-	-
10	<i>H. verschaffeltii</i> (Spindle palm)	+	B	-	-	-	-	+	-	-	XX	-
11	<i>Phoenix canariensis</i> (Canary Island palm)	+	A	-	-	+	-	+	+	-	-	-
12	<i>P. roebelenii</i> (Pygmy date palm)	+	A&B	-	-	+	-	+	-	-	-	-
13	<i>Pritchardia pacifica</i> (Fiji fan palm)	XX	XX	+	-	-	+	-	-	XX	+	+
14	<i>Rhapis excelsa</i> (Lady palm)	+	A	-	+	-	+	+	-	-	-	-
15	<i>Roystonea regia</i> (Cuban royal palm)	+	A	+	+	+	+	+	-	+	+	+
16	<i>Sabal palmetto</i> (Cabbage palm)	XX	XX	-	-	+	-	-	-	XX	+	-
17	<i>Washingtonia filifera</i> (California fan palm)	+	A	+	-	+	-	+	-	-	-	-
18	<i>W. robusta</i> (Washington palm)	+	A&B	+	-	+	-	+	-	-	-	-

*Names according to Meerow (1994).

(+) Disease present, (-) Disease absent & (X X) Not investigated .

(1)Palms grown in nurseries.

(2) Palms grown in landscape.

(3) Palms grown in nursery and landscape.

(1984) reported that one or more of soilborne fungi were the causal agents of such diseases on *Caryota mitis*, *Chamaedorea* spp., *Chrysalidocarpus lutescens*, *Howea forsteriana*, *Phoenix canariensis*, *P. roebelenii* and *Rhapis excelsa*. All of the reported soilborne fungi, i.e. *F. moniliforme*, *F. oxysporum*, *F. solani*, *Fusarium* sp., *Phytophthora* spp., *Pythium splendens*, *Pythium* sp. and *R. solani* were isolated in the present study.

The fungi associated with pink rot, Thielaviopsis disease and leaf spots mounted up to 18 fungal species (Table 3). However, 3-9 fungi were always isolated from each palm infected with one or more of the diseases studied. Pink rot (*G. vermoeseni*) was found to be associated with 4 fungi, while those of Thielaviopsis disease (*T. paradoxa*) with 9 fungi. Infected tissues with leaf spot symptoms yielded 12 fungal species, i.e.: *A. alternata*, *Alternaria* sp., *Bipolaris setariae*, *Calonectria theae*, *Colletotrichum gloeosporoides*, *Curvularia lunata*, *Exserohilum rostratum*, *F. moniliforme*, *F. oxysporum*, *F. solani*, *Fusarium* sp. and *Stemphylium* sp. On the other hand, *A. alternata*, *Alternaria* sp., *G. vermoeseni*, *T. paradoxa*, followed by *C. Lunata*, *E. rostratum*, *F. solani* and *Helminthosporium* sp. were the most frequent fungi associated with the three diseases studied.

Most species of *Chamaedorea* and *Chrysalidocarpus* were highly susceptible to infection with *Gliocladium vermoeseni* causing pink rot disease (Alfieri *et al.*, 1984; Forsberg, 1987 and Chase & Broschat, 1993). Also, *Archontophoenix alexandrae*, *Howea forsteriana*, *Rhapis excelsa*, *Phoenix roebelenii*, *P. canariensis* and *Washingtonia robusta* were infected with the fungus (Feather *et al.*, 1979; Chase, 1992; Chase & Broschat, 1993 and Lopez-Iiorca & Orts, 1994). On the other hand, the results regarding susceptibility of different palm species in Egypt to Thielaviopsis disease were in agreement with most of those mentioned by Chase & Broschat (1993). They reported that different distinct symptoms of the disease were recorded on palm species, viz. *Areca catechu*, *Caryota* spp., *Phoenix canariensis*, *Rhapis* sp., *Roystonea elata*, *Sabal palmetto* and *Washingtonia filifera*. As for leaf spots, Chase (1982), Alfieri *et al.* (1984), Forsberg (1987) and Chase & Broschat (1993) mentioned several fungal species as causal pathogens. These fungi were: *A. alternata*, *Alternaria* spp., *Bipolaris setariae*, *Calonectria theae*, *Colletotrichum gloeosporioides*, *Curvularia lunata*, *Exserohilum rostratum*, *F. moniliforme*, *F. oxysporum*, *Fusarium* spp., *Helminthosporium* sp. and *Stemphylium* sp. Also, they concluded that one or more of the recorded fungi infect(s) palms such as: *Archontophoenix alexandrae*, *Caryota mitis*, *Chamaedorea elegans*, *C. seifrizii*, *Chrysalidocarpus lutescens*, *Howea forsteriana*, *Phoenix canariensis*, *P. roebelenii*, *Rhapis excelsa*, *Roystonea regia* and *Washingtonia robusta*. Most of these results were, however, similar to findings reported herein.

Data in Table (4) show that root and stem tissues of *Archontophoenix alexandrae* and *Phoenix canariensis*, which were infected with Fusarium wilt, yielded *F. moniliforme*, *F. oxysporum* and *F. solani*. Isolation from *Roystonea regia* inflorescences infected with Khamadj disease gave *F. moniliforme*, *M. scaetiae*, *R. nigricans*, *Penicillium* sp.

Table (2): The associated fungi to damping-off (A) & root and/ or basal stem rot (B) diseases of 18 palm species (1996-2000).

No.	Fungi	The presence of fungi	Palms	The isolated fungi (Nos.)*
1	<i>Alternaria alternata</i>	A,B	<i>Archontophoenix alexandrae</i>	1,4,7,8,12,18, 19,23
2	<i>Aspergillus niger</i>	A	<i>Barahea armata</i>	2,3,5,11,19
3	<i>Botryodiplodia theobromae</i>	A,B	<i>Caryota mitis</i>	6,8,18,19,23
4	<i>Cladosporium</i> sp.	A	<i>Chamaedorea elegans</i>	1,6,8,17,18, 19
5	<i>Curvularia lunata</i>	B	<i>C. seifrizii</i>	5,7,8,12,19,20
6	<i>Fusarium equiseti</i>	B	<i>Chamaerops humilis</i>	1,10,18,19
7	<i>F. moniliforme</i>	A,B	<i>Chrysalidocarpus lutescens</i>	8,10,13,15,17,18,19,20
8	<i>F. oxysporum</i>	A,B	<i>Howea forsteriana</i>	1,9,17,18,19,21
9	<i>F. roseum</i>	B	<i>Hyphorbe lagenicaulis</i>	1,5,7,11,16,20
10	<i>F. semitectum</i>	B	<i>H. verschaffeltii</i>	3,6,8,11,13,23
11	<i>F. solani</i>	B	<i>Phoenix canariensis</i>	1,4,11,18,19,22
12	<i>Gliocladium vermoeseni</i>	B	<i>P. roebelenii</i>	1,6,11,14,18,19,23
13	<i>Helminthosporium</i> sp.	A	<i>Pritchardia pacifica</i>	1,11,12,14,22
14	<i>Macrophomina phaseolina</i>	B	<i>Rhapis excelsa</i>	7,11,12,18,19
15	<i>Nigrospora sphaerica</i>	B	<i>Roystonea regia</i>	1,3,6,7,8,11,13,18,23
16	<i>Penicillium roseum</i>	A	<i>Sabal palmetto</i>	5,9,11,18,19,21
17	<i>Phytophthora parasitica</i>	A,B	<i>Washingtonia filifera</i>	1,5,8,17,18,19,22
18	<i>Pythium splendens</i>	A,B	<i>W. robusta</i>	4,11,17,18,19,23
19	<i>Rhizoctonia solani</i>	B		
20	<i>Rhizopus nigricans</i>	A		
21	<i>Stemphylium</i> sp.	B		

* Numbers refer to fungi which were isolated from each palm.

A: Denote that this fungus is associated to damping-off symptoms.

B: Denote that this fungus is associated to root and/or basal stem rots.

and *Trichothecium roseum*. Also, Botryodiplodia rot on *Pritchardia pasifica* and *Roystonea regia* yielded *B.theobromae* and *Fusarium* sp. in isolation trials.

Fusarium wilt caused by *F.oxysporum* was reported on *P. canariensis* by Arai & Yamamoto (1977), Feather *et al.* (1979 & 1989) and Chase & Broschat (1993). Locally, *M. scaettae*, was found to cause leaf base rot on the ornamental palm *R. regia* (Abdel-Kader & Morsy, 1998) and inflorescences rot (Khamadj disease) on date palm (Badawy & Abdel-Al, 1982). As for the rot caused by *B.theobromae*, Lele *et al.* (1980) found that it is a destructive disease on *R. regia* in India.

III- Disease symptoms:

1- Damping-off:

The most common symptoms are poor stand due to decay of seeds before germination or seedlings before emergence from soil (Pre-emergence damping-off). The other phase is post-emergence damping-off, which leads to loss of seedlings after germination, may occur due to stem rot near the soil surface which causes the seedlings to fall over. The infected seedlings may be stunted and eventually die. Also, the young root may rot from the tips and the causal pathogen usually progresses up to the stem and the plant may eventually die. The observed damping-off symptoms were generally similar to those reported on ornamental plants (Baker, 1985) and on palms (Chase and Broschat, 1993).

2- Root rot:

In nursery, seedlings or mature palms with rotted roots usually exhibit the same disease symptoms in most cases (Figs.1,2). Foliar discoloration typical to that of nutrient deficiency, *i.e.* light green, yellow or bright yellow, appears and palm leaves may be wilted, dry and defoliate. Severely infected palms are usually stunted with very weak foliar development. On the other hand, scattered lesions appear as light to dark brown or gray to black discoloration are formed on infected roots. These lesions may coalesce to cover the entire surface of the roots, which are partially or completely decayed. Reduction in root system formation and/or malformed growth often appeared. Plant mortality is the culmination of root rot that has involved most of the root/or where the infection had progressed to the crown of the plant, blocking normal transport. In this respect, Linderman (1985) and Keim & Humphrey (1987) reported approximately the same symptoms on ornamental plants.

3- Pink rot:

Pink rot disease has been observed throughout the year in the greenhouses with predominantly mild temperature (18-28°C) and moist climate. On the other hand, se-

Table 3: The associated fungi with three foliar diseases; pink rot (A), Thielaviopsis rot (B) and Leaf spots (C), and fungi isolated from 18 palm species (1996-2000).

No.	Fungi	The presence of fungi	Palms	The isolated fungi (Nos.)*
1	<i>Alternaria alternata</i>	A,C	<i>Archontophoenix alexandrae</i>	1,2,9,14,15,17
2	<i>Alternaria</i> sp.	B,C	<i>Barahea armata</i>	—
3	<i>Bipolaris setariae</i>	C	<i>Caryota mitis</i>	3,6,7,13,14
4	<i>Botryodiplodia</i> sp.	B	<i>Chamaedorea elegans</i>	1,2,3,12,14
5	<i>Calonectria theae</i>	C	<i>C. seifrizii</i>	2,8,14
6	<i>Colletotrichum gloeosporides</i>	C	<i>Chamaerops humilis</i>	1,7,9,10,12,15
7	<i>Curvularia lunata</i>	C	<i>Chrysalidocarpus lutescens</i>	1,4,8, 9,14,17,18
8	<i>Exserohilum rostratum</i>	C	<i>Howea forsteriana</i>	1,2,5,7,8,10,12,14,17
9	<i>Fusarium moniliforme</i>	B,C	<i>Hyphorbe lagenicaulis</i>	1,10,11,16
10	<i>F. oxysporum</i>	C	<i>H. verschaffeltii</i>	1,2,15
11	<i>F. roseum</i>	B	<i>Phoenix canariensis</i>	2,4,12,17
12	<i>F. solani</i>	B,C	<i>P. roebelenii</i>	2,3,12,15,17
13	<i>Fusarium</i> sp.	A,C	<i>Pritchardia pacifica</i>	2,14,15,17
14	<i>Gliocladium vermoeseni</i>	A	<i>Rhapis excelsa</i>	1,6,7,8,13,14,15,17
15	<i>Helminthosporium</i> sp.	B	<i>Roystonea regia</i>	2,7,8,9,14,17,18
16	<i>Stemphylium</i> sp.	A,C	<i>Sabal palmetto</i>	2,12,15,17
17	<i>Thielaviopsis paradoxa</i>	B	<i>Washingtonia filifera</i>	2,8,14,17
18	<i>Ulocladium</i> sp.	B	<i>W. robusta</i>	1,2,7,8,14,17

* Numbers refer to fungi which were isolated from each palm.

A: Denote that this fungus is associated with pink rot symptoms.

B: Denote that this fungus is associated with Thielaviopsis disease symptoms.

C: Denote that this fungus is associated with leaf spot disease symptoms.

vere disease symptoms on landscape palms almost appear during winter season and they are never seen during hot summer months. In recent years, many mature palms, especially in coastal districts, have been destroyed by the severe and rapid spreading of the disease especially after excessive pruning or after being injured after uprooting from soil, during transportation or replanting in the new land.

Symptoms of the disease (Figs.3&4) firstly appear on basal stem part of the seedlings near the soil line as dark brown necrotic areas. Older fronds turn chlorotic and prematurely die. Orange to pink spore masses, often in sporodochia, readily form on these necrotic areas. Under severe infection, several infected stems die from girdling. On the other hand, symptoms usually appear on the old leaf bases and sometimes on the trunk of the infected landscape palms. Reduction in canopy of the diseased palms is usually observed. The disease is, however, described as producing discolored linear streaks on leaves, which become yellowish brown then die. Whereas dark-brown dry areas often appear on the infected trunks, pink spore masses of the fungus may be seen in blisters under the brown epidermis of the affected leaves and on the decayed areas of the trunk.

The predominant symptoms of the disease under Egyptian conditions were similar to those described by Feather *et al.* (1979), Onan & Karcilioglu (1987) and Chase & Broschat (1993).

4- Thielaviopsis disease:

Typical symptoms of the disease are only seen on the landscape palms as black scorch and trunk rot. The latter one is the most damaging disease symptoms (Fig.5), and may lead to death. Infected leaf tissues become blackish brown, then shrivel and form conspicuous lesions of a scorched, carbonaceous appearance. Blackish-brown lesions usually develop on external and internal tissues. Abundant chlamydospores forming in the tissues confers the black color. New leaves may exhibit the "bitten leaf" appearance as they emerge deformed, with smaller size and black necrotic tips. On the other hand, palm trunks are directly invaded by the causal pathogen through wounds caused by mechanical damage or growth cracks resulting from irregular moisture levels. A soft, yellow decay of the trunk tissue develops into dark, brown to black color with age. As decay progresses, a reddish-brown or rust-colored sap exudes from the site of invasion. This sap flow may extend several feet down the trunk, blackening the trunk as it dries. The trunk becomes hollow due to the decay of the interior tissues. The description of black scorch and trunk rot symptoms are similar to those reported on ornamental palms (Chase&broschat, 1993) and date palm (Carpenter & Elmer, 1978 and Rashed, 1998).

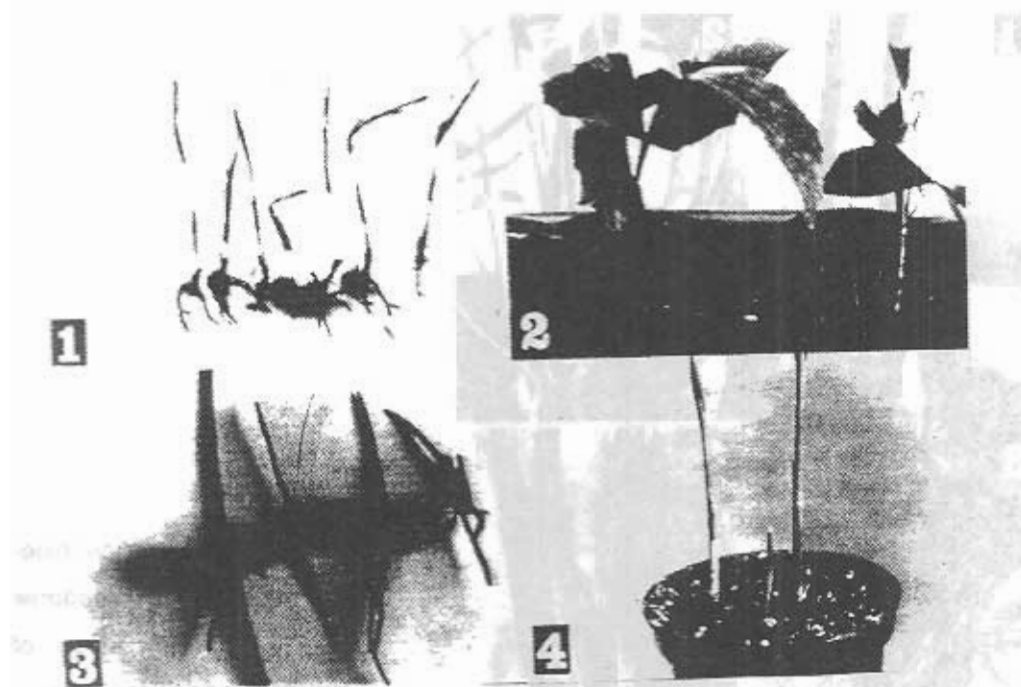


Fig 1: Root rot symptoms on *Chamaedorea elegans* (1), *Caryota mitis* (2) and *Howea forsteriana* (3&4).



Fig 2: Root rot symptoms on *Washingtonia filifera* (1), *Barahea armata* (2), *Archontophoenix alexanderae* (3), *W.robusta* (4) and *Chamaeropsis humilis* (5).

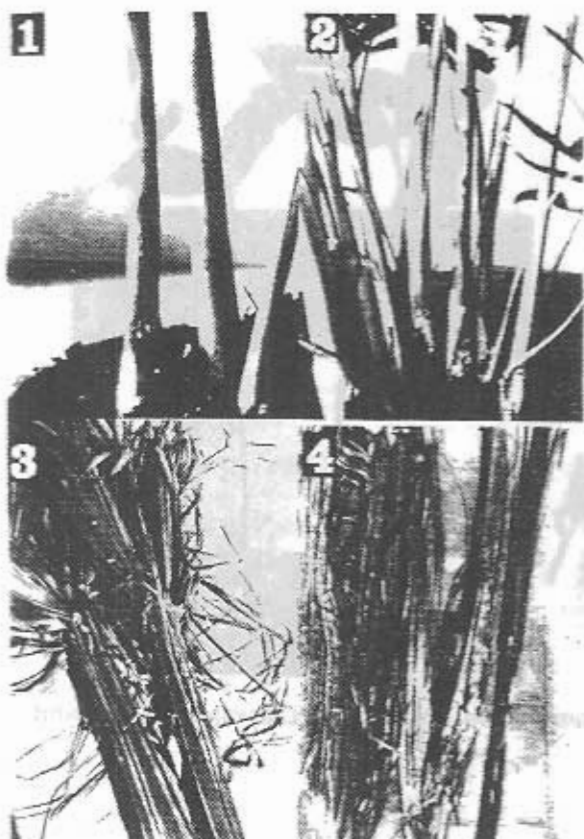


Fig. 3: Pink rot (*Gliocladium vermoseni*) stems of *Chamaedorae* sp. (1&2) and leaves of *Pritchardia pacifica* (3&4).

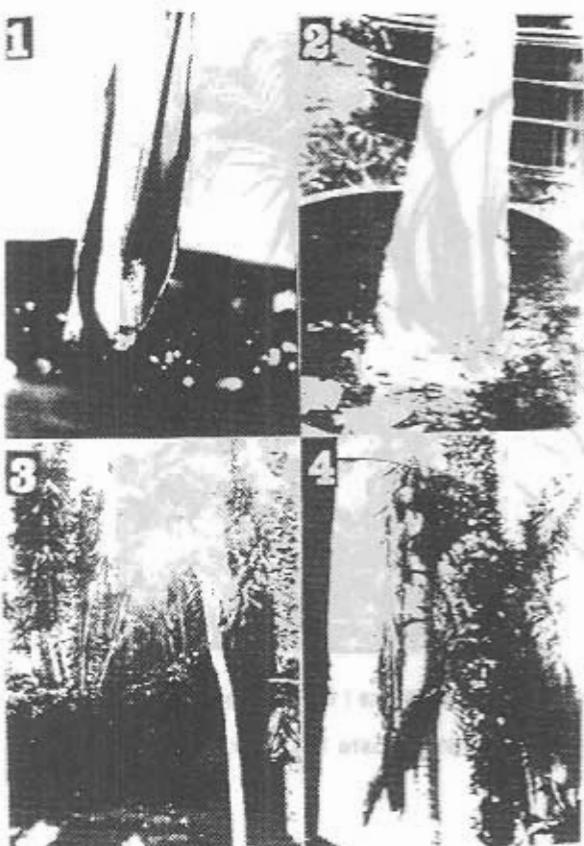


Fig. 4: Pink rot (*Gliocladium vermoseni*) on *Seaforthia elegans* (1&2), *Howea forsteriana* (3) & *Roystonea regia* (4).

Table 4: Fungi associated with Fusarium wilt (A), inflorescence rot or Khamadj disease (B) and Botryodiplodia rot (C), on 18 palm species (1996-2000).

No.	Fungi	The presence of fungi	Palms	The isolated fungi (Nos.)*
1	<i>Botryodiplodia theobromae</i>	B,C	<i>Archontophoenix alexandrae</i>	2,3
2	<i>Fusarium moniliforme</i>	A,B	<i>Barahea armata</i>	-
3	<i>F. oxysporum</i>	A	<i>Caryota mitis</i>	-
4	<i>F. solani</i>	A	<i>Chamadorea elegans</i>	2
5	<i>Fusarium</i> sp.	C	<i>C. seifrizii</i>	3
6	<i>Mauginiella scaettae</i>	B	<i>Chamaerops humilis</i>	-
7	<i>Penicillium</i> sp.	B	<i>Chrysalidocarpus lutescens</i>	-
8	<i>Rhizopus nigricans</i>	B	<i>Howea forsteriana</i>	-
9	<i>Trichothecium roseum</i>	B	<i>Hyphorbe lagenicaulis</i>	-
			<i>H. verschaffeltii</i>	-
			<i>Phoenix canariensis</i>	3,4
			<i>P. roëbelenii</i>	-
			<i>Pritchardia pacifica</i>	1,5
			<i>Rhapis excelsa</i>	-
			<i>Roystonea regia</i>	1,2,6,7,8,9
			<i>Sabal palmetto</i>	1,5
			<i>Washingtonia filifera</i>	-
			<i>W. robusta</i>	-

* Numbers refer to fungi which were isolated from each palm.

A: Denote that this fungus is associated with Fusarium wilt symptoms.

B: Denote that this fungus is associated with inflorescence rot or Khamadj disease symptoms.

C: Denote that this fungus is associated with Botryodiplodia rot symptoms.

5- Leaf spots:

Leaf spot symptoms on different palms are shown in (Figs. 5 & 6). Lesions are often sunken and vary in shape from circular or elliptical to irregular blighted areas. They are either small or large and may coalesce to cover most or the entire surface of infected leaves. Lesions color varies from orange, gray to light or dark brown and tan or black. A yellow halo may surround the lesion on leaves in case of some fungal infections. The youngest unopened leaf (spear leaf) may be infected, therefore, leaf spots appeared in regular lines and shapes on leaf surface after it was fully expanded. A complete disintegration of the affected tissues may occur within lesions on leaves of *Chamaerops humilis*. These general symptoms of leaf spots on ornamental palms in Egypt are in harmony with those described by Chase (1982), Forsberg (1987) and Chase & Broschat (1993).

6- Fusarium wilt:

The disease causes successive death of old leaves (Fig. 8-1) leaving only the juvenile ones intact. New leaves do not develop and the buds are invaded and eventually die. Collapse of the infected palm may occur within only few months. Examination of longitudinal or cross-sections made in roots of wilted palms exhibits reddish brown discoloration of xylem characteristic of vascular wilt diseases (Figs. 8-1 & 3). In this respect, Arai & Yamamoto (1977), Feather *et al.* (1989) and Chase & Broschat (1993) reported symptoms somewhat similar to those reported herein under Egyptian conditions.

7- Inflorescence rot or Khamadj disease:

Khamadj disease was seen only twice on Cuban royal palm (*R. regia*). Brownish or rusty areas develop on the unopened spathe after the fungus had already invaded the floral tissues. The internal tissues of the spathe under these lesions are yellow and translucent. Also, this spathe usually splits and reveals partial to nearly complete involvement of flowers and strands. On infected tissues, the fungus forms a distinctive white mycelial web, which later disappears, leaving a whitish bloom of spores on the surface. According to the available literature, the disease and its symptoms on inflorescences were only described on date palm (Badawy & Abdel-AI, 1982 and Carpenter & Elmer, 1978).

8- Botryodiplodia rot:

The disease is characterized by yellowish-brown streaks extending along the rachis. The lesions become brownish and the terminal bud may be infected. Symptoms include wilt as well as eventual desiccation of the youngest leaves which become yellowish-white in color. The folded new leaves can be easily detached by hand since their



Fig. 5: Thielaviopsis stem rot (*T. paradoxa*) on *Pritchardia pacifica*.

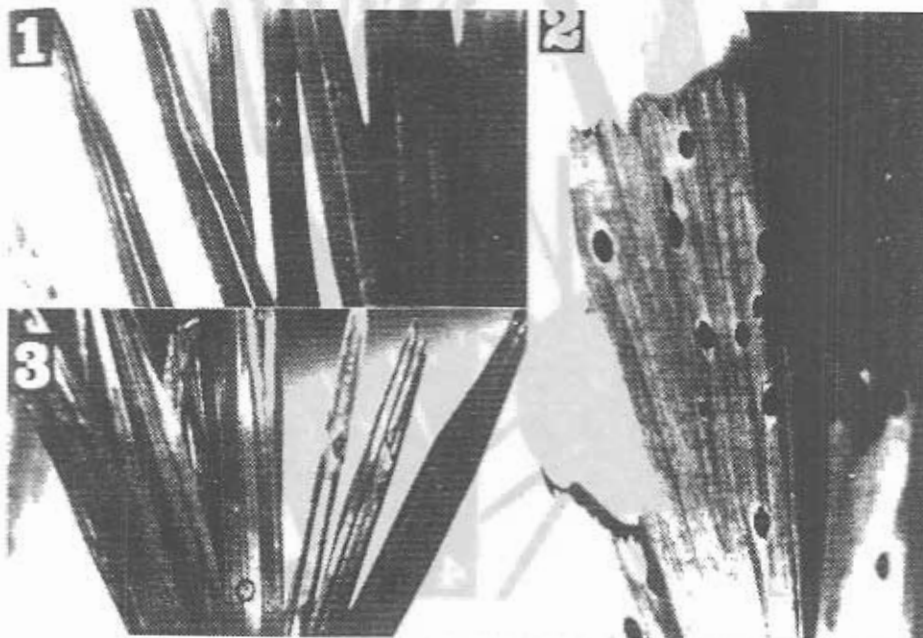


Fig. 6: Leaf spot symptoms on *Chrysalidocarpus lutescens* (1), *Caryota mitis* (2) and *Rhaps excelsa* (3).

bases are soft rotted, dead and covered with the blackish mycelial growth of the fungus. Sometimes, mature leaves remain healthy for several weeks after the death of the bud. On the other hand, the fungus can invade the unwounded trunk and disintegrates its fibers causing charcoal soft rot. The infected area is usually characterized by constriction and deep cracks (Fig. 4).

According to the available literature, Lele *et al.* (1980), described *B.theobromae* disease symptoms on the ornamental palm *Roystonea regia* in India. Some of these symptoms were, however, somewhat similar to these described in Egypt, especially on leaves and trunks. On the other hand, *B.theobromae* was found to be one of the causal pathogens of date palm diseases. Symptoms of infection appeared as necrotic tissues at the top of the palm, crown and terminal bud (Brun & Laville, 1965), trunk rot (Narendra *et al.*, 1979), and on young unopened crown leaves of off-shoots (Bhansali, 1989); however, yellowish-brown streak may appear on leaves and may result in death to bud of the off-shoots, which were experienced in Egypt (Rashed, 1991).

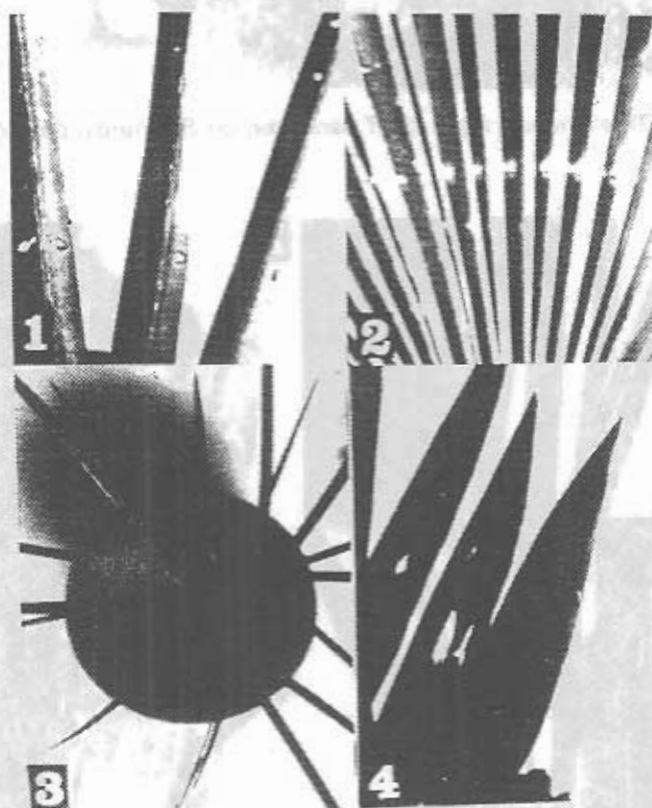


Fig. 7: Leaf spot symptoms on *Chamaerops humilis* (1&2), *Hyphorbe verschaffetti* (3) and *Howea forsteriana* (4).

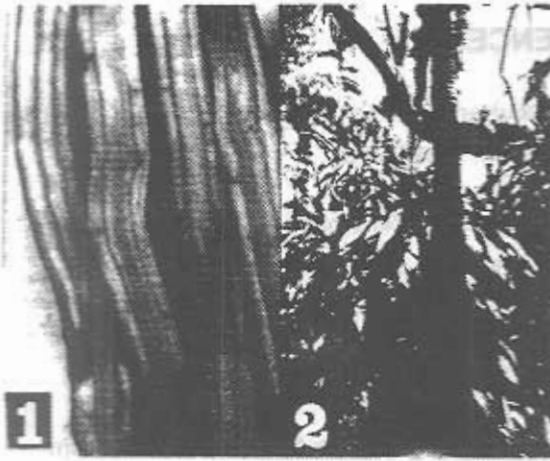


Fig. 8: Fusarium wilt symptoms on *Archontophoenix alexandrae* (2) with discoloration of xylem bundles in longitudinal (1) and cross (3) sections.

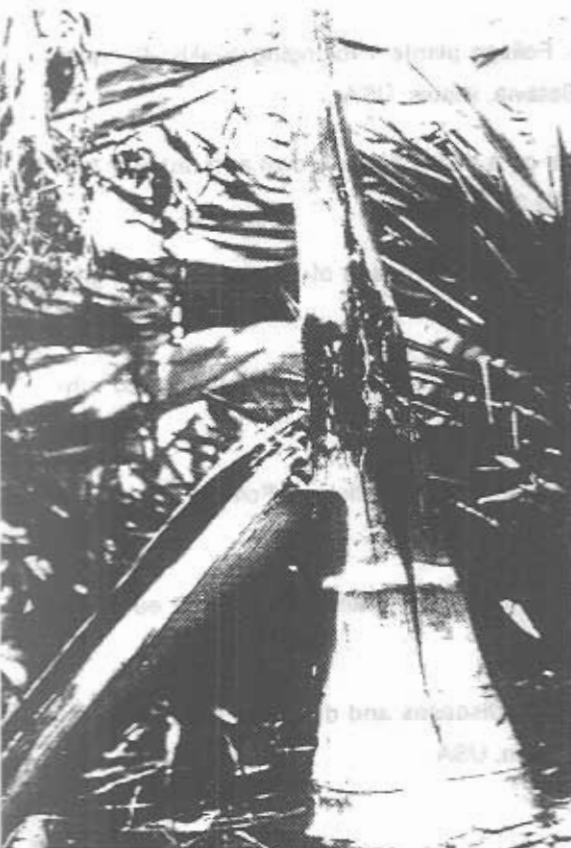
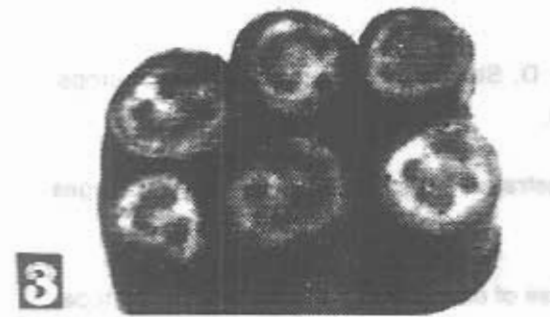


Fig. 9: Botryodiplodia stem rot on *Roystonea regia*.

REFERENCES

1. Abdel-Kader, M.M. and A.A.Morsy.1998. Occurrence of leaf base rot disease on royal palm (*Roystonea regia*). Egypt. J. Phytopathol., 26(2):89-95.
2. Alfieri, S.A., Jr., K.R. Langdon, C. Wehlburg and J.W. Kimbrough.1984. Index of plant diseases in Florida. Fla. Dept. Agric. & Consumer Serv., Div. Plant Ind., Bull. 11, USA.
3. Arai, K. and A.Yamamoto.1977. New *Fusarium* disease of Canary Island date palm in Japan. Bull.Fac. Agric., Kagoshima Univ. No. 27,pp. 31-37.
4. Badawy, M.F. and H.R. Abdel-Al. 1982. Studies on inflorescences rot disease of palm and its control in Sinai Peninsula.Res.Bull., Fac. Agric., Ain Shams Univ., Egypt, No.1819, 12 pp.
5. Baker, R.1985. Damping-off, pp.3-15. In: D. Strider (ed.): Diseases of floral crops. Vol.1, Preager Publishers, New Yourk, USA.
6. Barnett, H.C. and B.B. Hunter. 1972. Illustrated genera of imperfect fungi. Burges Publ. Co., Minneapolis, MN.
7. Bhamsali, R.R. 1989. Early leaf spot disease of date palm off-shoots. Indian Phytopathol. 42(2):418-420.
8. Blessington, T.M. and P.C. Collins. 1993. Foliage plants: Prolonging quality: Postproduction care & handling. Ball Publishing, Batavia, Illinois, USA.
9. Brun, J. and E. Laville. 1965. Observations on a decay of the crown and terminal bud of the date palm in Mauritania. Fruits, 20(8):391-397.
10. Carpenter, J.B. and H.S. Elmer. 1978. Pests and diseases of the date palm. Agric. Handb. No. 527, U.S. Agric. Dept., USA.
11. Chase, A.R. 1982. Dematiaceous leaf spots of *Chrysalidocarpus lutescens* and other palms in Florida. Pl. Dis..66: 697-699.
12. Chase, A.R. 1988. Diseases of foliage plants - updated listing. Foliage Digest, 11 (6):5-8.
13. Chase, A.R. 1992. Compendium of ornamental foliage plant diseases. 3rd ed., APS Press, St. Paul, Minneapolis, Minnesota, USA.
14. Chase, A.R. and T.K. Broschat (eds.). 1993. Diseases and disorders of ornamental palms. 2nd. ed. APS Press, St. Paul, Minnesota, USA.

15. Cline, M.N., G.A. Chastagner, M. Aragaki, R. Baker, M.L. Daughtery, R.H. Lawson, J.D. MacDonald, J.F. Tammen and G.L.Worf. 1988. Current and future research directions of ornamental pathology. *Pl. Dis.*, 72(11):926-934.
16. Farr, D.F., G.F. Bills, G.P. Chamuris and E.Y. Rossman. 1989. *Fungi on plants and plant products in the United States*. The American Phytopathological Society, St. Paul, Minnesota, USA.
17. Feather T. V., H.D. Ohr and D.E. Munnecke. 1979. Wilt and dieback of Canary Island palm in California. *Calif. Agric.*, 33(7/8):19-20.
18. Feather, T.V., H.D. Ohr, D.E. Munnecke and J.B.Carpenter. 1989. The occurrence of *Fusarium oxysporum* on *Phoenix canariensis*, a potential danger to date palm production in California. *Pl. Dis.*, 73:78-80.
19. Forsberg, L.I. 1985. Foliar diseases of nursery – grown ornamental palms in Queensland. *Australas Pl. Pathol.*, 14(4):67-70.
20. Forsberg, L.I . 1987. Diseases of ornamental palms. *Queensland Agric. J. (Australia)*, 113(5):279-286.
21. French, A.M. 1987. California plant diseases host index. Part 1: Fruit and nuts. *Calif. Dept. Food & Agric.*, 39 pp.
22. Keim, R. and W.A. Humphrey. 1987. *Diagnosing ornamental plant diseases: An illustrated handbook*. Univ. Calif., Div. Agric. & Nat. Res., USA.
23. Keim, R. and G. Maire, 1975. Gliocladium disease of palm. *Calif. Plant Pathol. No. 27*, pp. 1-2.
24. Knauss, J.F. 1974. Common diseases of tropical foliage plants. II. Soilborne fungus diseases. *Florists' Rev.* 154 (3987):66-67, 114-122.
25. Knauss, J.F. 1975. Common diseases of tropical foliage plants. III. Soilborne fungus diseases. *Univ. Fla., Agric. Res. Center, Apopka Res. Rep. RH75-8*, 10pp.
26. Knauss, J.F., S.A. Alfieri, Jr., R.B.Marlatt and F.W. Zettler. 1981. Foliage plant diseases, pp.350-427. In: J.N. Joiner (ed.): *Foliage plant production*. Englewood Cliffs, N.J.: Prentice-Hall Inc.
27. Lele, V.C., J.N. Kapoor and V.V. Chenulu. 1980. A destructive fungal malady of royal palm in Delhi. *Pesticides*, 14 (8): 19-21 (c.f.*Rev.Pl.Pathol.*,60 (8): 421,1981).

28. Linderman, R.G.1985. Root rots, pp. 153-172. In: D. Strider (ed.): Diseases of floral crops. Vol.1, Prager Publishers, New York, U S A.
29. Lopez-Liorca, L.V. and S. Orts. 1994. Histopathology of infection of the palm *Washingtonia filifera* with the pink bud rot fungus *Penicillium vermoeseni*. Mycological Research (Spain), 98(10): 1195-1199.
30. Meerow, A.W. 1994. Betrock's guide to landscape palms. Betrock Information System, Inc. Hollyood, Florida, USA.
31. Miller, P.M.1955. V-8 juice agar as general purpose medium for fungi and bacteria. Phytopathology, 45: 461-462.
32. Narenda, D.U., T. Nezzal and J.C.Sautiago. 1979. Heart rot of date palm. FAO PI. Prot. Bul., 27: 132-133.
33. Onan, E. and A. Karcilioglu. 1987. Bud rot (*Penicillium vermoeseni* Biourge) disease of ornamental palms. J.Turkish Phytopathol.,16(3) :131-132.
34. Plyler, T.R., G.W.Simone, D.Fernandez and H.C.Kistler. 1999. Rapid detection of the *Fusarium oxysporum* lineage containing the Canary Island date palm wilt pathogen. Phytopathology, 89 (5):407-413.
35. Rashed, M.F.1998. Pathological studies on black scorch disease of date palm. Ph.D. Thesis, Fac. Agric., Cairo Univ., Egypt.
36. Rashed, M.F. 1991. Pathological studies on fungi causing deterioration of off-shoots in Egypt. M.Sc. Thesis, Fac., Agric., Cairo Univ.
37. Reynolds, J.E. 1964. Gliocladium disease of palm in Dade country, Florida. PI. Dis. Repr..48: 718-720.
38. Schulman, J.F.1971. Etiology of a disease complex in *Chamaedorea elegans*. M.Sc. Thesis, Univ.Florida, USA.
39. Stewart, L.1994. A guide to palms and cycades of the world. Cassell plc., London, U K.

الأمراض الفطرية الغير مسجلة و التي تصيب نخيل الزينة في مصر

١. حصرها مع وصف أعراضها و عزل و تعريف الفطريات التي تصاحبها

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قسم بحوث أمراض نباتات الزينة و الطبية و العطرية-معهد بحوث أمراض النباتات
مركز البحوث الزراعية-الجيزة مصر-١٢٦١٩

أجرى حصر- لأول مرة في مصر - في خمسة محافظات في الفترة ١٩٩٦-٢٠٠٠م بغرض تسجيل الأمراض الفطرية التي تصيب ١٨ نوعا من النخيل المنزرعة في المشاتل وخارجها. و لقد أثبتت نتائج هذا الحصر وجود ثمانية أمراض فطرية مختلفة في أهميتها. و لقد كانت أمراض: موت البادرات، أعفان الجذور و قواعد السوق بالإضافة إلى تبقعات الأوراق الأكثر خطورة و انتشارا في المشاتل بينما كانت أمراض: العفن القرنفلي (الفطر: جليوكلاديم فيرموسينى) ، تبقعات الأوراق (المتسبية عن العديد من الفطريات) ، اللسعة السوداء (الفطر: ثيلافيويسز بارادوكسا) هي الأمراض الرئيسية المنتشرة على النخيل المنزرع خارجيا، في حين كانت أمراض: الذبول الفيزاريومي (الفطر: فيوزاريوم أوكسيسبورم)، عفن الأزهار أو مرض الخامج (الفطر: ماجنيلا سكاتا) و العفن البتريودييلودي (الفطر: بتريودييلوديا ثيوبوروما) هي الأمراض نادرة الانتشار على النخيل المنزرع خارجيا، ويعتبر ذلك الحصر أول تسجيل لهذه الأمراض الفطرية التي لم تكن معروفة من قبل و ثبت أنها تصيب العديد من نخيل الزينة في مصر.

ولقد أثبتت نتائج الحصر أيضا تسجيل كل من الأمراض الخمسة- ذات السيادة في الانتشار على نخيل الزينة في المشاتل و خارجها- على العديد من أنواع نخيل الزينة، بينما تم تسجيل الأمراض نادرة الحدوث (الأقل انتشارا) على عدد قليل من أنواع النخيل مثل أمراض: الذبول الفيزاريومي على النوعين: أرشنتوفونكس ألكسندري و فونكس كانارينسس، و مرض الخامج على النوع: رويستونيا ريجيا و العفن البتريودييلودي على الأنواع: بريتشارديا باسيفيكا، رويستونيا ريجيا و سابال بالميتو. كما تم تسجيل العدد الأكبر من الأمراض على النوعين: أرشنتوفونكس ألكسندري و رويستونيا، ريجيا، بينما تم تسجيل أقل عدد من الأمراض على النوعين: براهيا أرماتا و سابال بالميتو. و لقد تضمن هذا البحث تعريف الفطريات التي تم عزلها و المصاحبة لأعراض الأمراض التي تم تسجيلها وكذا وصف كامل للأمراض العامة لبعضها و تلك المميزة للبعض الأخر بالإضافة إلى بعض الصور الفوتوغرافية لهذه الأعراض.