PINK ROT OF *WASHINGTONIA FILIFERA* (LIND. EX ANDRÉ) H. WANDL.; A NEWLY RECORDED DISEASE CAUSED BY A DIFFERENT SPECIES OF *GLIOCLADIUM* IN ALEXANDRIA, EGYPT

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ABSTRACT

Pink rot disease of Whashingtonia palm trees prevailed in Alexandria from the period of 2002 to 2005 in Alexandria region of Egypt where the weather in winter seasons was rainy and cold. It was proved that a different species of Gladiocladium namely; G.roseum is responsible for disease incitation. It was also shown that there is an effect of the distance between palm trees and the seashore on disease severity and the nearer Whashingtonia palm trees from the seashore, the higher the possibility for the trees of being infected.

Screening of palm trees genera for resistance to the pathogen, using wounded detached leaf method, showed that Chamaerops humilis, Sabal palmetto, Caryota mitis, Zamia floridana, and Rapis excelsa were resistant to the pathogen while Areca catechu and Washingtonia filifera were susceptible. However, the resistance pattern will slightly differ when either the whole plant test method or leaf blade and petiole / rachis cuts are used.

Sensitivity test to certain fungicides revealed that carbendazim , score, and mancozeb were the most effective fungicides inhibiting the growth of the pathogen.

Key words: *Pink rot, Washingtonia filifera , Gliocladium roseum, Chemical control , Fungicides, Screening methods for resistance.*

INTRODUCTION

California fan palm (*Washingtonia filifera* (Lind ex Andre) H.Wandl.) is a large fan palm tree native to the west coast of the United States and Mexico (Riffle and Craft, 2003). *Washingtonia filifera* palms are commonly cultivated as ornamental street and landscape trees in coastal areas (Elkiey, 1993). According to Jones (1995), they are very popular in cultivation and grow very well in not only coastal districts but also mountainous regions and from the tropics to cool-temperate climates. In Alexandria, these palms are used on a large scale in urban and residential areas. Moreover, they are extremely prolific and well established in different parts of Egypt, including its north-western resorts and recreation areas.

California fan palm trees are unfortunately attacked by several fungal diseases. Biourge, 1923 named and described a pink rot disease which had injurious effects on Areca palms in greenhouses in Belgium. Chevalier (1924) reported that the same disease incited by *Gliocladium vermoeseni* to cause death to *Archontophoenix cunninghamiana, Howea fortesiana, Washingtonia filifera,* and *W. robusta* (Downer, 2003). The disease was also reported in California (Bliss, 1938) and Florida (Mcritchie, 1976 and Meerow, 2005). Moreover, Feather *et al.,* 1989 described pink rot as part of a disease complex along with *Fusarium oxysporum* on *Phoenix* palms.

The death of some *Washingtonia* trees in different locations of Alexandria city was frequently observed in the last few years (2002 – 2005). As the extent of the phenomenon was increasing from year to year, especially when a rainy windy cold weather prevailed during winter, it was necessary to carry out this study to survey disease incidence, isolate and identify the causal agent(s), study its parasitic propensities among the common genera of palm trees and explore a control measure by determining the inhibitory effect of certain fungicides on the growth of the causal agent(s).

MATERIALS AND METHODS

Washingtonia filifera palm trees growing in Alexandria streets were surveyed for disease symptoms. Three different locations in Alexandria were selected to conduct a field survey for diseased palm trees. The three surveyed locations were "26 July Street, El- Goomrok district"; 100 meters from the seashore, "Abou-kier Street, Ibrahimia and Sporting district"; about one Km from the seashore, and " Fawzy Maaz Street, Smoha and Al-Nozha districts"; about two Km from the seashore. The percentage of diseased palm trees in each location was calculated and Chi square was used as a test for independence. Samples of palms, showing disease symptoms, were collected, put in plastic bags, and kept inside ice chests during transportation to laboratory, then in a refrigerator at 4 °C.

Isolation of the causal agent was carried out. Small pieces of diseased plant parts were surface sterilized in 1% sodium hypochlorite solution for 5 minutes, then rinsed in sterilized water and plotted dry between two folds of sterilized filter papers. Surface sterilized plant parts were plated onto potato dextrose agar (PDA) medium supplemented with 100 ug / ml tetracycline, to eliminate bacterial contamination, in 9-cm diameter Petri dishes and kept under observation at room temperature (20 – 25 oC) for 7 days.

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Purification of fungal cultures was made using either single spore isolation or hyphal tip method before identification of the fungal isolates.

The pathogenicity of isolated fungi was tested using three different methods:

(a) Inoculation of whole plants

Five year-old palm trees of four genera namely; *Areca catechu* L., *Cocos plumosa* Hook, *Livistonia chinensis* (Jacq.) R. Br. and *Washingtonia filifera* (Lind. ex Andre) H. Wandl. in pots were used to test the pathogenicity of isolated fungi. Blades and rachis/petioles of the leaves of young palm trees were surface sterilized using a cotton swap impregnated with 1% sodium hypochlorite solution for 5 minutes before inoculation. Then, a spore-suspension, containing 1×10^7 spore-suspension /ml, was sprayed on both surfaces of palm leaves using a hand atomizer. Inoculated leaves were covered with polyethylene bags for 24 hours after inoculation. Leaves sprayed with tap water served as a control. At the same time, rachis/petioles of the leaves of test palm trees were wounded with a sterilized scalpel (1cm long on one side). Then, a 6mm diameter disc of mycelium from a 7-day- old culture of the test fungus growing on PDA medium was inserted inside the tissues of the rachis/petiole which was covered with aluminum foil to prevent dryness of fungal inoculum. 6mm diameter disc of only PDA medium was inserted inside leaf rachis/petiole to serve as a control. Inoculated young palm trees were kept under observation in the glasshouse at 17 – 25 °C for symptoms development. Efficacy of each treatment was estimated according to the following disease scale:

0 = no infection
1 = weak infection
2 = moderate infection
3 = severe infection
4 = very severe infection

And disease severity was calculated according to the following formula:

$$\text{Disease severity} = \frac{\text{SUM (score} \times \text{number)} \times 100}{4 \times \text{Total number}}$$

previously used by Abdel-Kader and Morsy, 1998.

(b) On detached leaves

This technique was used to screen ten genera of palm trees for disease resistance. The palm tree genera tested were as follows: *Areca catechu* L., *Caryota mitis* Lour., *Chamaerops humilis* L., *Cocos plumosa* Hook., *Cycas revoluta* Lour., *Livistonia chinensis* (Jacq.) R.Br., *Rapis excelsa* L.F. ex Alt, *Sabal palmetto* (Walt.)Lodd. Ex Schult. Et Schult.f., *Whashingtonia filifera* (Lind. Ex Andre) H.Wandl., and *Zamia floridana* DC.Coontie. Comptie. Leaves of each genus palm tree were washed with tap water and surface sterilized 1% hypochlorite solution for 5 minutes, put in one liter flasks containing tap water to keep leaves alive during the test. One centimeter wound was made in the petiole of each detached leaf with a sterile scalpel and a 6mm disc of the test fungus taken from a 7-day-old culture on PDA, was inserted inside the tissue of wounded leaf petiole, and then wrapped with aluminum foil to prevent drying. A 6mm disc of PDA only was inserted in the tissues of wounded leaf petiole to serve as a control. Inoculated detached leaves in flasks were kept at room temperature for one month for symptoms development. Disease severity in different treatments was estimated according to the previously mentioned formula using the same disease scale.

(c) Inoculation of leaf blade/petiole cuts:

Leaf petiole/blade cuts (2-3cm long) of the test palm genera were washed under tap water, surface sterilized in 1% sodium hypochlorite solution for 5 minutes, rinsed in sterilized water, and put in deep Petri dishes (4 cuts each). Sterilized cuts were soaked in a conidial spore- suspension (1×10^7 spores / ml). A piece of wet cotton was put in each Pertri dish to maintain humidity in order to keep cuts alive. Petri dishes containing inoculated cuts were kept at room temperature (20 – 25° C) for symptoms development. Disease severity in different treatments was estimated as previously mentioned.

Effect of certain fungicides on fungal growth:

Seven fungicides were tested for their effect on the radial growth of the isolated fungi. The fungicides tested were:

Carbendazim: 50 % WP methyl benzimidazole - 2-carbamide.

Mancozeb: 80 % WP complex Champion: 77 %WP Cupper hydroxide of Zinc and maneb (Manganese ethylene dithiocarbamate) containing 20% manganese and 2.5 Zinc.

Ridomil: 72 %WP Metalaxyl

Score: 25% EC Difenoconazole

Soryl: 80% micronized Sulpher

Vitavax: 200 (carboxin+thiram) 17% carboxin, 2-Methyl-5,6-dihydro-[1,4]oxathiine-3-carboxylic acid phenylamide, 17% thiram, alpha'-Dithiobis (dimethylthio) formamide.

Different concentrations (0.02, 0.04, 0.08, 0.12, 0.24 and .48 %) of each of the tested fungicides were investigated. Controls free of fungicides were used for each fungus. Precooled (45 °C) PDA medium thoroughly mixed with the appropriate amount of the fungicides was poured into Petri plates and left to solidify then a 6mm diameter disc from a 7–day–old culture of the test fungus was placed at the center of each plate. The plates were kept in an incubator at 25 °C. Five replicates were used for each treatment. Colony diameter measurements (cm) were taken

7 days after inoculation. Each colony was measured twice along axes separated by 180 degrees. Data were statistically analyzed using SAS program.

RESULTS

Symptomology:

Visible dark brown lesions develop on leaf petioles, leaf blades, and the terminal bud tissues of both young and old palm trees. A brown line surrounded by a yellow halo appears on infected leaf petiole starting from leaf base upwards. In rainy cold weather, where high humidity prevails for a long period of time, the pathogen grows on the surface of infected tissues producing masses of pink spores, Fig. (1). Infected old leaves die prematurely and droop, while infected young leaves turn yellow Fig. (2). In case of severe infection, the whole palm tree eventually dies.

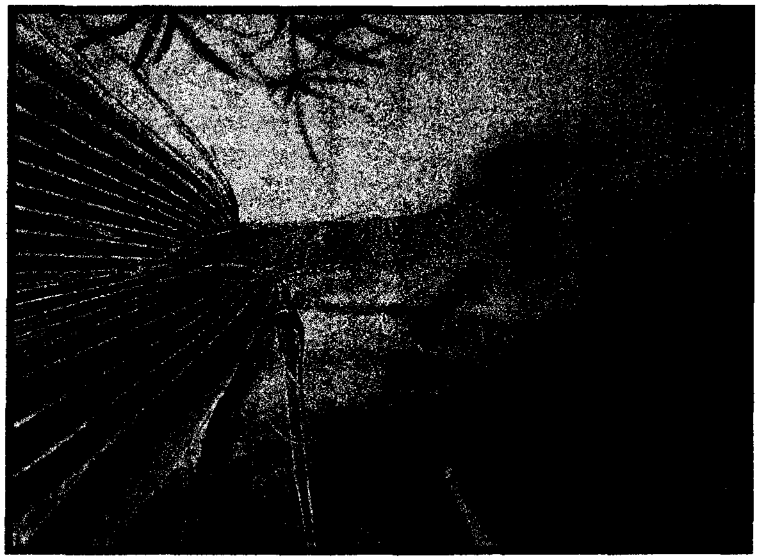

Fig. (1): Symptoms of pink rot on the petiole of infected *Washingtonia filifera* leaf, where masses of pink colored spores of the pathogen are observed.

Fig. (2): A severely infected *Washingtonia* tree, showing dead drooping old leaves and yellow young leaves.

Data in Table (1) indicate that the nearer the palm trees from the seashore the higher the percentage of disease incidence. Chi square test for the independence of disease incidence on the distance between palm trees and the seashore was statistically significant.

All new infected palm trees were observed in winter. It was also noticed that the number of new infected trees and consequently disease severity were very pronounced and much higher in cold rainy and windy winter than in relatively warm and dry winter seasons. Furthermore, it was observed that most of infected trees were old tall trees which were generally more than fifty years old. Furthermore, higher numbers of infected trees were found in highly traffic regions such as Al-kornish and Abou-keir streets (Table1).

Table (1): Percentages of diseased Washingtonia palm trees in three different locations of Alexandria city.

Location	Approximate distance from the seashore	Total Number of investigated palm trees	% Diseased palm trees
26 July Str., Elgoomrok district	100 m	120	17.5
Abou-Kier Str.Ibrahimia and Sporting district	1 Km	141	15.6
Fawzy Maaz Str., Smoha and and Al-Nozha districts"	2 Km	142	6.3

Chi square calculated = 8.66
Chi square (p 0.05) = 5.991

Isolated fungi:

Fungi isolated from diseased leaf parts of *Washingtonia filifera* included three different species namely: two species of *Fusarium*, and one species of *Gliocladium*. (Gilman, 1945).

Fungal identification:

***1- Fusarium oxysporum* Schlechtendahl**

Stroma brownish-white to violet, plectenchymatic, extended or colored green to blue-black by erumpent, sclerotial hard bodies, and 0.5-3mm. or3-6 mm. in thickness, more or less wrinkled, under moist conditions, usually covered by fascicled, medium-high aerial mycelium, later forming sporodochia, more seldom pionnotes with three-septate spindle-sickle-shaped cinidia, one- or two-celled, oval to typical fruiting layers of the macroconidia: 0-septate, 5-15×2-4 µm,1-septate, 10-26*2-4 µm,3-septate, 19-45×2.5-5 µm. Chlamydospores terminal and intercalary, globose, smooth or wrinkled one-celled in hyphae ,5-15 µm.

***2- Fusarium proliferatum*(Matsushima) Nirenberg:**

Hyphae are septate and hyaline. Conidiophores are medium length, simple or branched. Conidiogenous cells are monophialides and polyphialides. Microconidia are abundant, single-celled and clavate, measure 4.5-10.5 × 1.3-2.5 µm, and are borne from both monophialides and polyphiades in false heads and in chains. Macroconidia may be rare, and are very similar to those see in *F. moniliforme* as conidiogenous cells are monophialides. Macroconidia are sparse, very slightly sickle-shaped to nearly straight, i.e., "string bean-like", 5-septate, measuring 31-58 x 2.7-3.6 µm.. Chlamydoconidia are absent.

***3- Gliocladium roseum* (Link) Thom:**

Colonies on PDA loose floccose, with simple hyphae and ropes of hyphae, white to pink or salmon in fruiting areas; reverse colorless (Fig.3a). It produces dense irregular pinkish masses of conidia (Fig.3b). Conidiophores are borne as branches of aerial hyphae, 45-125 µm long. Conidial fructification enclosed in slime, up to 140 µm long, in two or three stages, phialides 12-17×2-3 µm bearing conidia in gelatinous balls or masses. Conidia colorless (pink or rosy in mass), elliptical, 5-7×3-5 µm, slightly apiculate, smooth, appearing granular within. These characteristics are in agreement with those given by Gilman.1945 for *Gliochladium roseum* (Link) Thom.

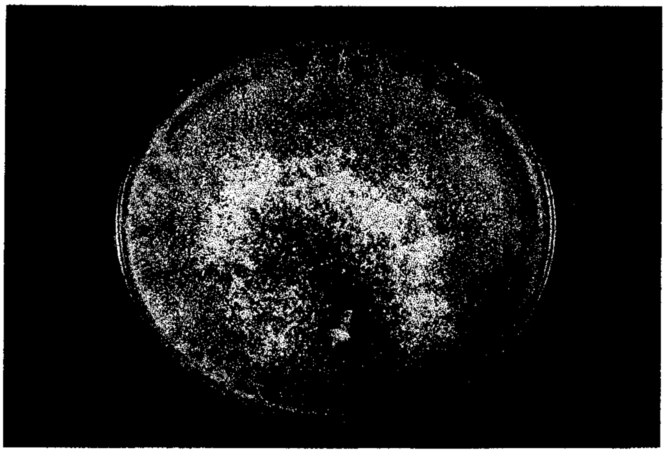

Fig. (3a): A ten day old culture of *G.roseum* grown on PDA at 20° C showing pink colored mycelium.

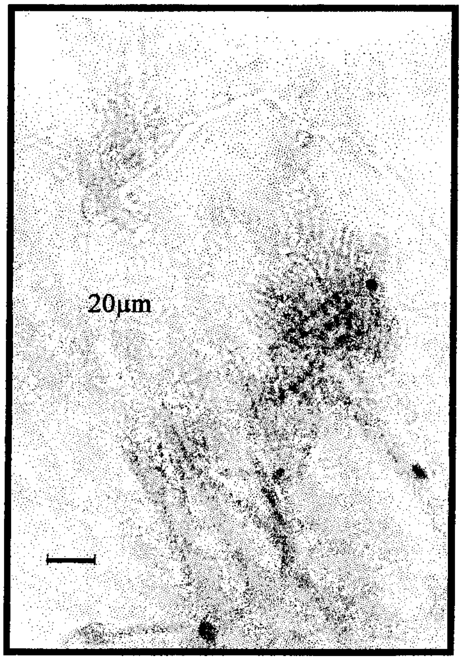

Fig. (3b): A photo micrograph of G. roseum showing the septated mycelium, conidiophores with phialides and conidia in short chians (100x)

Pathogenicity fungal isolates:

a) On whole palm trees:

No lesions could be observed on wounded leaves of palm trees of each of the four genera tested namely; *Areca catechu, Cocos plumosa* , *Livistonia chinensis*, and, *Washingtonia filifera* when isolates of *Fusarium moniliforme*, and *F. proliferatum* were used for inoculation. However, an isolate of *Gliocladium* was able to infect each of the four tested genera of palm trees causing different degrees of disease severity (Table 2) and Fig. (4).

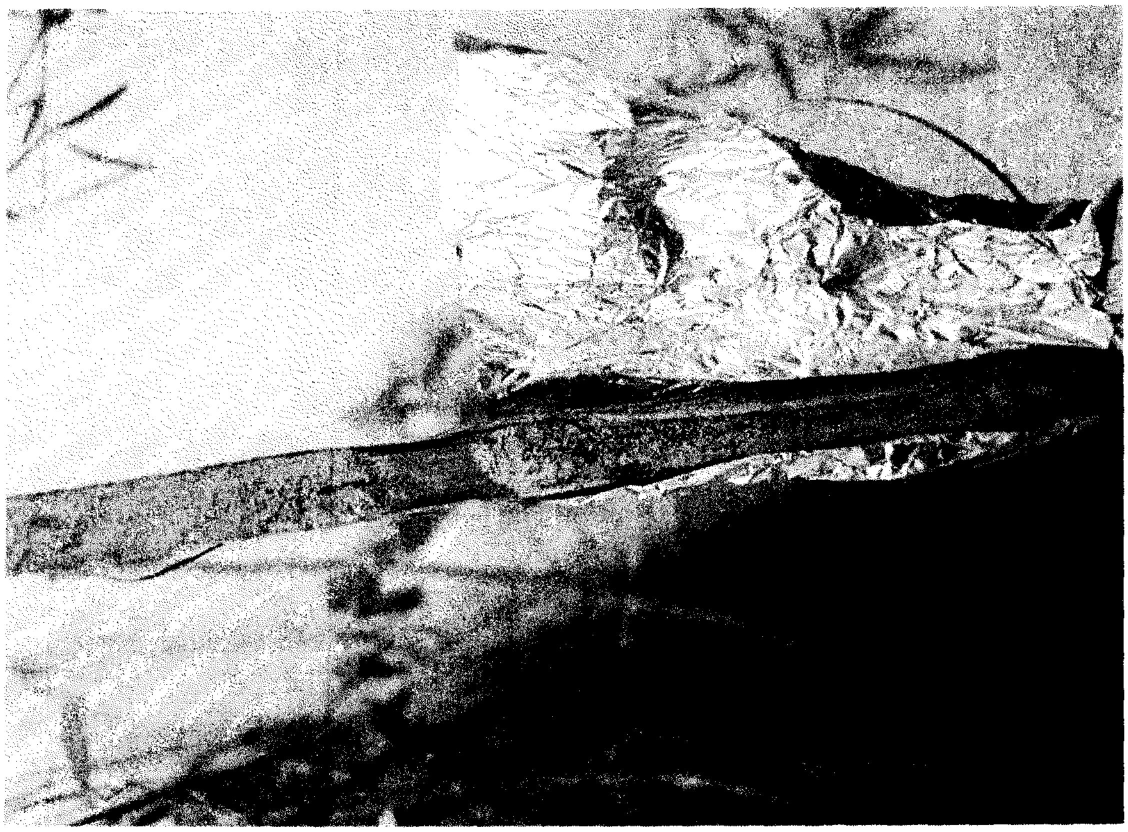

Fig. (4): Artificially infected leaf of *Washingtonia filifera*, showing severe symptoms of pink rot and pink masses of spores of the pathogen *G. roseum* on leaf petiole.

Table (2): Pathogenicity of *Gliocladium roseum* on four year-old palm trees in pots, two months after inoculation at 20 -25° C.

Palm species	Disease Severity %
Areca catechu	60.00
Cocos plumosa	26.56
Livistonia chinensis	15. 63
Washingtonia filifera	15.36
L. S.D. at 0.05	28.145

Data in Table (2) show that disease severity caused by the test isolate of *Gliocladium roseum* to the different genera of palm trees on both leaf blades and petioles varied according to the genus inoculated. *Areca catechu* was the most susceptible genus as disease severity reached as high as 60.0%, if compared with either *Livistonia chinensis* or *Washingtonia filifera* with relatively low disease severities being only 15.63 % and 15, 36%, respectively.

Table (3): Pathogenicity of *Gliocaldium roseum* on wounded detached leaves of nine genera of palm trees, four weeks after inoculation at room temperature (20 – 25° C).

Palm Species	Disease Severity %
Areca catechu	90.00 A
Washingtonia filifera	90.00 A
Livistonia chinensis	52.00 B
Cycas revoluta	52.00 B
Chamaerops humilis	0.83 C
Sabal palmetto	0.83 C
Caryota mitis	0.83 C
Zamia floridana	0.83 C
Rapis excelsa	0.83 C
L.S.D. 0.05	5.923

b) On detached leaves

Areca catechu and *Washingtonia filifera* out of nine genera tested were the most susceptible to infection by *Gliocladium roseum* where disease severity was as high as 90.0%(Table 3). *Livistonia chinensis* and *Cycas revoluta* were less susceptible with a lower disease severity (52.00 %). Five genera namely; *Chamaerops humilis*, *Sabal palmetto*, *Caryota mitis*, *Zamia floridana*, and *Rapis excelsa* were resistant as disease severity was only 0.83 % (Fig. 5).

Data also show that detached leaf test was able to screen palm tree genera for resistance to *Gliocladium roseum* dividing them into three different groups which differed significantly from each other, namely: highly susceptible, susceptible and resistant. However, the disease severity level was relatively higher for those genera tested by both ways of inoculation (*Areca catechu, Livistonia chinensis,* and *Washingtonia filifera*) than that observed when whole plants were used for inoculation as seen in Table2 &3.

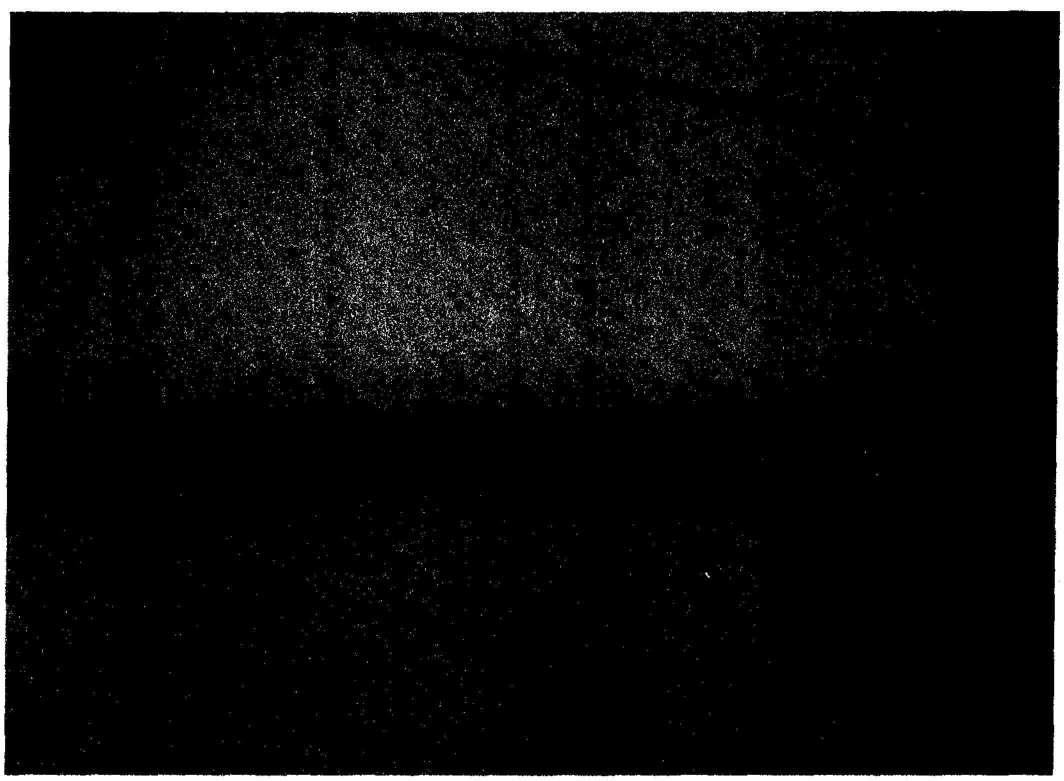

Fig. (5): Artificially inoculated leaf of *Chamaerops humilis* with *G. roseum*, showing very limited brown lesions after two months of infection at 20-25 °C .

Table (4). Pathogenicity of *Gliocladium roseum* on wounded leaf blade, and petiole/rachis cuts of different genera of palm trees, four weeks after inoculation at room temperature (20-25 °C).

Palm Species	Disease Severity %	
	Blade cuts	Rachis /petiole cuts
Caryota mitis	60.00* A	60.00 A
Chamaerops humilis	60.00 A	60.00 A
Washingtonia filifera	60.00 A	57.00 A
Rabis excelsa	60.00 A	60.00 A
Areca catechu	45.00 A	60.00 A
Livistonia chinensis	26.60 B	56.18 A
Cycas revoluta	25.74 B	57.00 A
Cocos plumosa	19.10 B C	41.14 B
Sabal palmetto	4.88 D C	24.14 C
Zamia floridana	0.70 D	0.70 D
L.S.D. 0.01	15.94	7.51

* Means of five replicates

c) on leaf blade and rachis/petiole cuts:

Pathogenicity test on leaf blade and petiole/ rachis cuts was successful in screening the ten genera tested of palm trees to four categories regarding their susceptibility to *Gliocladium roseum*. The four groups are as follows: group A (highly susceptible) which showed the highest disease severity (45 – 60 %) and included five genera, namely: *Caryota mitis, Chamaerops humilis, Washingtonia filifera, Rapis excelsa* and *Areca catechu*, group B (susceptible) with disease severity ranged from 19.10 to 26.6 % and included two genera, namely: *Livistonia chinensis* and *Cycas revoluta*, group C (moderately susceptible) with disease severity ranged from 4.88 to 19.10 % and included two genera, namely: *Cocos plumosa* and *Sabal palmetto*, and group D (resistant) which showed the least disease severity ranged from 0.70 to <4.88 % and included only one genus namely; *Zamia floridana* (Table 4). Furthermore, the same trend was also observed in both cases with a slight difference between leaf blade and leaf rachis/petiole test. In case of petiole/rachis cuts, it showed either the same or a higher disease severity percentage in nine out of ten genera, namely: *Caryota mitis, Chamaerops humilis, Rapis excelsa, Areca catechu, Livistonia chinensis, Cycas revoluta, Cocos plumosa* , *Sabal palmetto* and *Zamia floridana*. *Washingtonia filifera* showed a slight decrease in disease severity than it was with leaf blade test but it is still within the limits of the same highly susceptible group (group A) .

Effect of Fungicides on Fungal Growth:

Data presented in Table (5) indicate that the most effective fungicides on radial growth of *G. roseum* were carbendazim , score , and mancozeb, as their minimal inhibitory concentration (MIC) was 0.0 2 per cent . On the other hand, Ridomil, champion and soryl were the least effective fungicides. The MIC for them were 0.12 ,o.24, and 0.48 %, respectively.

Table (5): The minimal inhibitory concentration of different fungicides for *G. roseum* grown on PDA medium at 20 oC for 10 days after inculation (four replicates were used for each treatment).

Fungicide	MIC %
Carbedazim	0.02
Score	0.02
Mancozeb	0.02
Ridomil	0.12
Champion	0.24
Soryl	0.48

DISCUSSION

Pink rot of palm trees, in general, and *Whashingtonia* palm trees, in particular, is a very important disease especially in cold cloudy and rainy weather. It is a real threat to old neglected *Whashingtonia* palms, which is subjected to pollution, resulting from gasses emitted from motor cars running in the cities like Alexandria.

The disease symptoms were described and the associated fungi were isolated purified and identified. The causal agent is a wound parasite which was identified as *Gliocladium roseum* not *G. vermoeseni* (Bourge) Thom. which was recorded to be the causal agent of the disease in several countries outside Egypt (Biourge, 1923; Chevalier, 1924; Bliss, 1938; Westcott, 1960; Kein & Maire, 1975 and Donselman, 1998).

The fact that *Gliocladium roseum* has been proved to be the causal agent of pink rot disease of palm trees in Egypt is very interesting and, as far as the available literature is concerned, it is the first time to be recorded as the causal agent of pink rot of *Washingtonia* palm trees in Egypt and the world (Westcott,. 1960). In spite of the isolation three fungi associated with the disease symptoms, *Gliocladium roseum* was the only fungus which was able to infect the wounded whole plants. Except for Feather *et al,* 1989 who described pink rot as part of a disease complex along with Fusarium oxysporum on Phoenix palms (Downer, 2003), our results are in agreement with many other authors (Biourge, 1923; Chevalier, 1924; Bliss, 1938; Kein & Maire, 1975 and Donselman. 1998)

Host range studies revealed that the pathogen was able to infect the different genera of palm trees and cause pink rot though at different levels of disease severity. Such result is quite important for disease control as it gives a free lance for the people in ornamental fields to choose a resistant genus of palm trees for cultivation among the highly resistant genera found (Table 2, 3, 4).

The method used for screening for resistance was also simplified by using either detached leaves or leaf blade, and petiole/rachis cuts instead of whole transplants which are valuable and expensive. These simplified methods are quite reliable for large scale screening for resistance as they give comparatively stable pattern of disease reaction according to the degree of resistance of the different tested palm genera though at higher disease index.

It was also observed that the recommendations of Plant Pathology Department for pink rot control were fortunately adopted by the staff of Alexandria governorate where the infected old *Washingtonia* palm trees were removed as they were a continuous threat for pedestrians and nearby cars and a source of inoculum. Consequently, the pink rot disease severity was greatly decreased reaching a very low level. Moreover, no new spots of pink rot were observed. This could be also due to other environmental factors as mild winter accompanied by very low rate of rains prevailed in Egypt in the last few years.

A preliminary experiment for testing the effect of certain fungicides on the linear growth of the pathogen was carried out. Carbendanzim, score and mancozeb were the most effective in inhibiting linear fungal growth while ridomil, champion and soryl were the least effective in inhibiting fungal linear growth.

A field experiment for chemical control of pink rot disease is underway.

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الملخص العربى

تسجيل جديد لنوع آخر من فطر الجليوكلاديم *Gliocladium* يسبب العفن القرنفلى لنخيل الواشنجطونيا فى مدينة الإسكندرية، جمهورية مصر العربية

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[1، 2] قسم أمراض النبات ، [3] قسم الزهور والزينة

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ظهر مرض العفن القرنفلى على اشجار نخيل الواشنجطونيا فى منطقة الإسكندرية بدرجة كبيرة فى السنوات من ٢٠٠٢ الى ٢٠٠٥ حيث ساد طقس بارد عاصف وممطر فى فصل الشتاء أثناء تلك الفترة وقد لوحظ ان النخيل المهمل والقديم اكثر عرضة للإصابة بالمرض وثبت من هذا البحث ان نوعا مختلفا من فطر الجليوكلاديم *Gliocladium* وهو الجليوكلاديم روزيم *G. roseum* وليس جليوكلاديم فيرموسيناى *G. vermoeseni* والمعروف انه هو المسبب لمرض العفن القرنفلى على النخيل عادة فى كثير من بلدان العالم وبالتالى يكون هذا أول تسجيل للنوع جليوكلاديم روزيم *G. roseum* على نخيل الواشنجطونيا فى مصر حسب ما هو متوفر من مراجع .

وأوضحت الدراسة ان هناك تأثيراً للمسافة ما بين أشجار النخيل وشاطىء البحر المتوسط على شدة الأصابة بالمرض فكلما قربت أشجار النخيل من الشاطىء كلما زاد احتمال إصابتها بالمرض . كما أثبتت الدراسة ايضا ان الأجناس المختلفة للنخيل تختلف فى قابليتها للإصابة او مقاومتها للمرض وعليه تم اختبار مقاومة عدة أجناس للمرض بطرق مختلفة مبسطه ونظراً لارتفاع قيمة وندرة بعض أشجار أجناس النخيل وبدلا من إجراء الاختبار على نبات كامل أمكن الوصول الى نتيجة متقاربة باستخدام أوراق النخيل المنفصلة او أجزاء منها مع اختلاف درجة الإصابة فى كل حالة . مما يتيح إجراء اى عدد من اختبارات العدوى بغرض أختبار مقاومة الأجناس او الأنواع الأخرى للمرض .

تم عمل اختبار لتأثير عدد من المبيدات الفطرية على نمو فطر الجليوكلاديم روزيم وثبت ان أكثرها فاعلية فى إيقاف نمو الفطر هى بالترتيب كاربندازيم وسكور ومانكوزيب .

كان من بين توصيات مقاومة المرض ازالة أشجار النخيل المهملة والقديمة والتى يتجاوز عمره أكثر من خمسين سنة حيث يعتبر مصدراً للعدوى وحينما طبق ذلك بواسطة محافظة الإسكندرية تم محاصرة المرض ولوحظ عدم وجود بؤر جديدة له.