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A NEW DISEASE INFECTED BASAL STEM OF MANGO TREES CAUSED BY *GANODERMA* SP. IN EGYPT.

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ABSTRACT

During the last few years a new disease symptoms appeared and spread on mango trees in Ismailia Governorate from which *Ganoderma* sp. was frequently isolated. The disease starts as rot in the basal area of mango trees, followed by the growth of distinctive structures known as "brackets" and finally plant death. Three isolates is of *Ganoderma* sp. were isolated for the frist time from naturally infected mango trees in three locations at Abo-Swear district El-Karakrah , Abo-Kharwae and El-Wasfia) , Ismailia Governorate , Egypt . Microscopic examination of isolated pure cultures showed hyphal system trimitic(generative hyphae , skeletal hyphae and binding hyphae),basidiospores and chlyamidospores.) of *Ganoderma* sp. Pathogenicity test on mango transplants , with isolated *Ganoderma* sp., under greenhouse conditions revealed that *Ganoderma* sp. was pathogenic and it caused sudden wilt root rot and dieback causing wilt to inoculated mango transplants. In the same time, results indicate that the artificially inoculated discs of different other fruit and wood trees (Host range) in their susceptibility to the pathogen under study based on the external rotted discs of tested woody plants. Mango and kaki exhibited 100% of rotted discs two week after inoculation. On the contrary, no fungal growth was observed on inoculated guava and olive discs under the same conditions. In the meantime, *plum,* casuarina and *berry* showed 77.8, 62.0 and 56.8 % infection in inoculated discs, respectively .Starch and mannose used as carbon source recorded a noticeable increase in the linear growth of *Ganoderma* sp. study followed by sucrose in Ganoderma growth medium, maltose and manitol. The tested fungus gave maximum growth rate on Yeast extract 10 days after incubation at 25 ^{o}C followed by Molt extract, Peptone and Ammonium sulphate which found to be best source of nitrogen for this fungus. The optimum temperature for the linear growth of *Ganoderma* sp. ranged from 20 to 30 ^{o}C. *T. harzianium* recorded the highest percentage of inhibition against *Ganoderma sp.* followed by *T. virens*. However, *Chaetomium globosum* showed the lower percentage of inhibition.

Keywords: Generative hyphae, skeletal hyphae, binding hyphae , basidiospores , chlyamidospores , host rang and biological control.

INTRODUCTION

Mango trees suffers from several diseases at all stages of their life. During the last few years a new disease symptoms appeared on mango trees in Ismailia Governorate. The first sign of disease is usually dieback of a branch. Slowly other branches die, until the whole tree is dead; this can take several years. Leaves turn yellow and fall. However, the internal symptoms of the disease appeared as white rot in the heartwood; the tree becomes hollow and may remain stable, but decay usually leads to weakening and eventual breakage or wind throw. Patches of dark-brown, water-soaked tissue appear at the base of the stem and extend upwards (stem bleeding). Roots become friable and white mycelial mats occur in these tissues. Brackets (basidiomata)

can be observed on the trunk. In the same time, symptoms of infection include loss of canopy foliage, yellowing leaves and dying branches. The bracket appears usually accompanied by extensive heartwood decay, its decay weakens the wood and falling branches.

This is followed by exudation of reddish brown liquid through cracks at the base of the trunk and oozing spread upward. The tissues on the bleeding spots are soft to touch, Fig. (1) Similar symptoms were reported by Rolph *et al*., (2000) and Reda - Labiba (2013) on some woody trees. This new disease was spread and recorded in mango orchards of three villages; El-Karakrah, Abo-Kharwae and El-Wasfia at Abo-Swear district.The aim of this work was to identify the fungal pathogen causing a new disease of mango trees growing in Egypt for the first time. The study including morphological (both macroscopically and microscopically) characteristics, host range, physiological and biological control studies on the fungal pathogen.

Fig.(1): Symptoms of white rot on the basal mango trunk : A):Exudation of reddish brown liquid through cracks at the trunk and spreading upward.(B)Heart rots of standing trees in the central and on-living woody tissues,(C): basidiocarp (conk) on mango trees trunk.,(D) white-margined, reddish-brown flat structures on the stem (I) .

MATERIALS AND METHODS

Isolation

Samples of the diseased stem tissues (wood trunk internal and external) and fruiting bodies of *Ganoderma* sp. were collected from 3 mango

orchards at Abo-swear district (El-Karakrah , Abo-Kharwae and El-Wasfia) , Ismailia Governorate. Isolation of associated pathogen was carried out from the small pieces of infected wood and from basidiomata (4x4x5mm) were cut, surface sterilized in 5% sodium hypochlorite for 3min,washed several time in sterilized distilled water transferred onto PDA medium in Petri dishes plates and all plates were incubated at 25^{o}C. Visible mycelia grown from the pieces of basidiocarpe or infected trunk of diseased tree was sub cultured onto fresh PDA medium until pure cultures were obtained .The purified isolates were maintained on the same medium at 4-5^{o}C for further studies.

Identification of the causal organism: Identification of the isolated fungi was carried out according to the morphological features, macroscopic, microscopic and cultural characteristics.

Morphological characteristics includes macroscopic studies such as basidiocarp, color, margin shape and pore color shape were examined and noted as described by Gottlieb and Wright (1999). However, microscopic studies for internal morphology, free - hand sections were taken from the cutis treated with 5%KHO solution, washed with water and staining in cotton blue (1%, in Lacto phenol). Microscopic details of structures such as types of hyphal system, the diameters of basidiospores, mean length, mean width and size range were determined by measuring 20 basidiospores, Holmgren *et al*., (1990). The slides were examined using light microscope of 10x eyepiece and 10x, 40x and oil immersion *i.e*.100x objective lens Foroutan and Vaidya, (2007). Isolates were grown on PDA medium at 25±1ºC for 10 days for cultural studies and examined at 3–days intervals for Chlamydospore formation.

Pathogenicity tests: Pathogenicity tests with the three isolates of *Ganoderma* sp. isolated from 3 villages ; El-Karakrah, Abo-Kharwae and El-Wasfia at Abo-Swear district were carried out under greenhouse conditions at Faculty of Agriculture Farm, Suez Canal University during April 2011 on mango transplants. Mango transplants, cultivar **S**acchari, 2 years old grown in plastic bags were obtained from commercial suppliers of mango nurseries in Ismailia. The fungal inoculum, grown on PDA, 15 days after incubation at 25 ^{o}C at the rate of 5% w/w was placed in close contact with the root systems. Eight replicates were used for each isolate and another 8 replicates were used without inoculum as control.Koch,s procedure steps was followed and re-isolation of the fungus from artificially infected mango transplants to proof similarity of both symptoms and characterization of the fungus in natural infected mango trees .

Host range : Artificial inoculation with spore suspension of El-Karakrah, *Ganoderma* isolate which only produced basidiocarp on infected tree , 15 days old cultural at concentration of 10^{4},spores/ ml was carried out on discs obtained from woody branches ranged from 2-3 cm diameter x1cm height of ten hosts of woody and fruit trees including mango, olive, Kaki, Plum, Casuarina, Berry, Gloabe, Pear, Pomegranate and Guava .Another set of discs were used without inoculation and left as control .Discs were surface sterilized in calcium hypocloride (5%) for 5 min then washed severel times in sterilized distilled water the plotted between sterilized filter papers till dryness.

The inoculated and non-inoculated discs were incubated at 25^{o}C for 15days then percentage of infection was recorded for each host.

Effect of favorable nutrient sources:

A-Effect of carbon sources: Suitable carbon sources were screened by the three isolates of *Ganoderma* sp. on Czapek's Dox medium. The medium was first prepared without any carbon source .After preparation, the media was supplemented with one of 10 carbon sources: starch, mannose, sucrose, maltose, manitol, fructose, glucose, lactose, lactic acid and oxalic acid at a concentration of 2%. A 5mm diameter plug of Ganoderma isolate was placed in the center of the Petri dish, 3 replicates were used for every particular treatment, incubated in the dark for 10 days at 25^{o}C. The mycelial growth of the colonies was recorded according to Woo-Sik *et al*., (2009)

B- Effect of Nitrogen sources : To screen for nitrogen sources suitable for the mycelial growth of *Ganoderma* sp. grown on Czapek's Dox medium supplemented with each of 11 nitrogen sources: yeast extract , moult extract, peptone, ammonium sulphate, ammonium nitrate, ammonium chloride, ammonium acetate, calcium nitrate, potassium nitrate, sodium nitrate and urea at a concentration of 0.2% was carried out *in vitro*. A 5mm diameter plug of an inoculum of *Ganoderma* sp. was placed in the center of the Petri dish, 3 replicates plates were then incubated in the dark for 10 days at 25^{o}C. The mycelial growth of the colonies were evaluated, Woo-Sik *et al*., (2009).

Effect of different temperature degrees on the fungal growth *in vitro*: The growth of the *Ganoderma* sp. was evaluated at temperatures 10, 15, 20, 25, 30 and 35^{o}C. The fungal was cultured on PDA for 10 days and the mycelial growth was determined as described above. Emel Karadeniz *et al* ., (2013).

Biological control of *Ganoderma* sp. : Screening experiment was conducted in vitro to find out the antagonistic effect of two species of *Trichoderma*: *T.harzianum*, *T. virens* and one species of *Chaetomium globosum* against *Ganoderma sp.* on PDA medium plates using dual culture technique Dhingra and Sinclair (1985).The three antagonistic fungi were supplemented from International Mycology Center, Faculty of Science, Assiut University. Discs of mycelium (5mm diameter) of each of the selected fungal isolates were cut from the edge of an actively growing fungal colony with a cork borer. Test plates were prepared by pouring 20 ml of PDA per plate. After solidification, one mycelial disc of individual isolate of *T. harzianum* and one disk of test fungal pathogen was placed simultaneously on the edge of the each PDA Petri plate at opposite direction. Three replicated plates were used for each isolate of antagonistic fungi and the test pathogen. The plates received only mycelial discs of the test pathogen served as control. The plates were incubated in the laboratory having ambient temperature of 25±1 ^{o}C until mycelium of the test pathogens *Ganoderma* sp cover the whole control plate. Thereafter, inhibition percentages of *Ganoderma* sp was calculated based on the growth dimensions of the pathogen on PDA plates following the formula as suggested by Sundar *et al.,* (1995).

RESULTS AND DISCUSSIONS

Isolation and identification: Isolation of the causal agent of stem basal rot mango trees was carried out on PDA medium. Microscopic examination of isolated pure cultures showed different types of septate mycelium, hyphae with clamp connections and basidiospores of *Ganoderma* sp. Rate of growth of these fungal mycelia was high on the same medium and numerous aerial hyphae with numbers of side branches were observed. Three isolates . were isolated from naturally diseased mango trees in three locations at Abo-Swear district (El-Karakrah , Abo-Kharwae and El-Wasfia) . Identifications of the three isolated fungi were carried out according to the morphological features, macroscopic, microscopic and cultural characteristics. Morphological characteristics includes macroscopic studies such as basidiocarp, color, margin shape and pore color shape were examined and noted as described by Gottlieb and Wright (1999) and Seo and Kirk (2000) . The obtained 3 isolates of Karakrah, Abo-Kharwae and El-Wasfia were identified as *Ganoderma applanatum* (Pers.) Pat. according to Bhosle *et al*., (2010)

Morphological studies: Macroscopy and microscopy are the simplest methods to establishthe correct identity of source materials Jafari *et al*., (2013).

Macroscopic characterizes:Basidiocarp annual, sessile, corky to woody. Pileus reniform, up to 12 ×20 × 2 cm; upper surface brown or reddish brown, concentrically sulcate and zonate, rugose, laccate; context wood-colored to brown, 1-1.5 cm thick ; Fig.(1C).Pore surface cinnamon, brownish to brown, 4-5 per mm.

Microscopic characterizes: Hyphal system trimitic; (Tertiary Mycelium): generative hyphae hyaline, thin-walled,septate, branched with clamp connection , 3.5-4.5 µm diam. ; skeletal hyphae yellowish brown, thick-walled, aseptate , unbranched , aciculiform 2.5-4.0 µm and binding hyphae, slender thick-walled, sinuous, branched, 1.5-2 µm diam.Fig.(2). However, the color of the spore mass seen on the collection slides was yellowish brown of the 3 isolates. Isolates produced basidiospores which were ovide, truncate at the apex shape bitunicate; exospore hyaline, smooth, endospore echinulate, brownish or goloden. The mean length of basidiospores varied between isolates ranging from 7.3to 12.9 µm and width varied ranging from 4.9 to 8.6 µm**.** Chlamydosporesboth intercalary and terminal, thick walled,, ellipsoid to ovoid, 9–14.5×6.5–9.5 µm.Fig.(3).

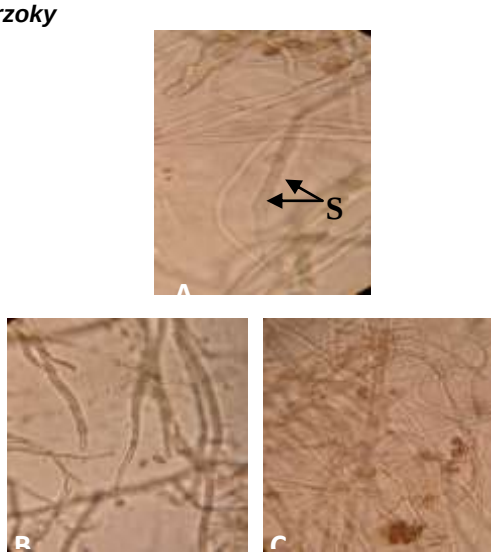

Fig.(2): Hyphal system of *Ganoderma* (Tertiary mycelium), A: generative hyphae thin-walled, with clamp connections, septa, branched ., B:skeletal hyphae arboriform, clampless, aseptate, thick–walled, unbranched and C: binding hyphae bovista type, .40x
S: Septa

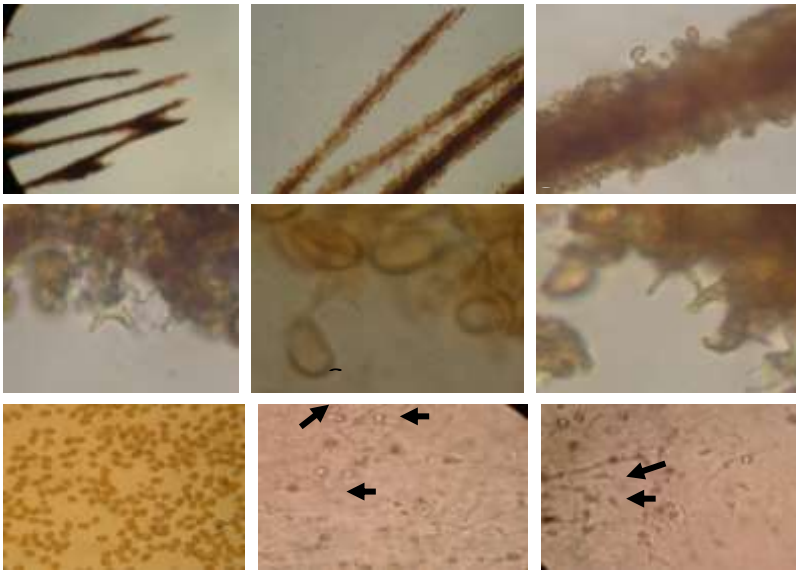

Fig.(3): A: Low magnified portion of a cross section through the lamella of *Ganoderma* sp.(5x) ,B: Higher magnified portion of the section through the lamella of *Ganoderma* sp. Basidiospores visible on the upper and lower edge of lamella.(10x). C (40x), D, E and F (100x): High magnification of basidia. Basidium showing basidiospores on sterigmata. G: basidiospores (10x); Hand I Chalymidospores (40x)
St = sterigmata - s= basdiospores - b= Basidium

Colony morphology:

Colonies of the three isolates of *Ganoderma* sp. showed white color on the surface and creamy white color on reverse. Fig.(4). There were wide variations between isolates, colonies diameter ranged from 18 to 53 mm after 5 days and 36-88mm after 10 days. All isolates grew to complete the Petri dish, 10 days after incubation.

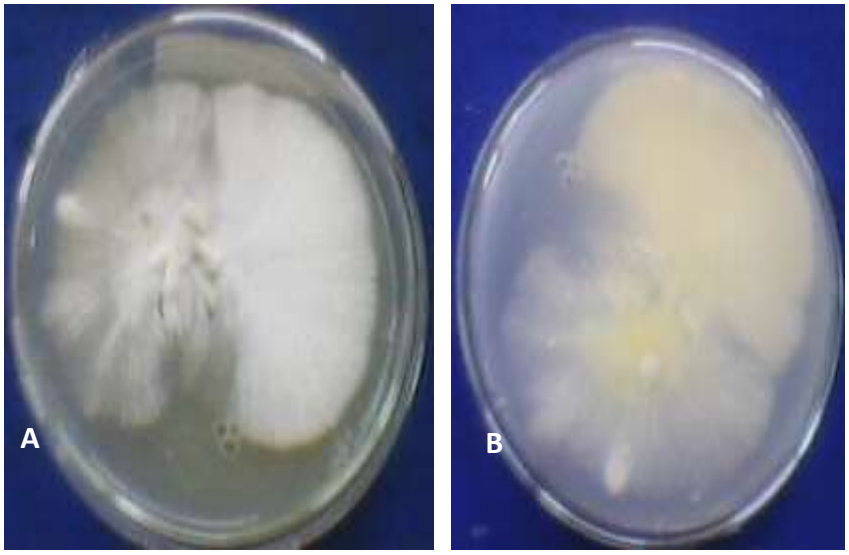

Fig.(4): The white mycelium colony of *Ganoderma* sp. grown on PDA medium 10 days after incubation at 25 ^{o}C , upper surface (A) and on reverse(B)

Pathogenicity tests on mango and certain hosts of isolated *Ganoderma* sp. *in vitro*:

A-Artificial inoculation on mango transplants: Wilt symptoms were observed on mango transplants, 2 years old artificially inoculated with *Ganoderma* sp. 6 months after inoculation. The isolate caused root rot symptoms, sudden wilt without any yellowing symptoms, and dieback within 6 months after inoculation. Fig. (5) , Karthikeyan *et al.,* (2007) reported that the visible symptoms on coconut palm seedlings 5 months after *G.lucidium* inoculation . Reisolation of the tested fungus which infected mango transplants was successfully carried out on potato dextrose agar. Pathogenicity test proved that the fungus *Ganoderma* sp. infected mango roots through artificial infested soil which means that the pathogen can spread and infect roots of mango transplants in nurseries with or without wounds. Rees *et al.,* (2009) reported that colonization by *Ganoderma boninense* can occur through unwounded roots then progresses mainly through the inner, thin-walled cortex.

Fig.(5): A: Artificial inoculation with *Ganoderma* sp on mango transplants ,two years old ,6 months after inoculation. Showing sudden wilt symptoms (B): control

B-Artificial inoculation on certain hosts : Data presented in Table (1) indicate that the fungus *Ganoderma* sp .attacks all discs of mango and kaki (100%). The fungus decayed rapidly the inoculated discs and the infected tissues becomes white and soft

Results indicated that artificially inoculated discs of the tested hosts differed in their susceptibility to the pathogen under study based on the external rotted discs of tested woody plants (Fig.6). The pathogen exhibited the highest percentage of rotted discs (100%) mango and kaki two week after inoculation. On the contrary, no fungal growth was observed on inoculated guava and olive discs under the same conditions which means that both of the hosts are resistant to the pathogen under study. In the meantime, *plum,* casuarina and *berry* showed 77.8, 62.0 and 56.8 % infection, respectively. It is also clear that glosbe *recorded* 40.0 % infection followed by pear and pomegranate (both showed 20%) infection. In general, indicate that the two commercial hosts, mango and kaki, were the most susceptible hosts to *Ganoderma* disease, while pomegranate discs was the least susceptible. Pathogenicity tests on different woody discs of plant hosts clearly indicate that the pathogen can infect mango trunk and woody stems through wounds and mechanical injuries. In general, the obtained results indicate that *Ganoderma* sp. was found to have a broad host range. In this respect, Rees *et al*., (2012) showed for the first time that basidiospores can germinate abundantly on cut surfaces of oil palm(fronds, peduncles, and stem) under plantation conditions.

Table (1) : Percentage of fungal growth on different woody discs of plant hosts *in vitro* at 25 °C , 15 days after inoculation (El-Karakrah, isolate).

Artificially inoculated Hosts		**percentage of the rotted discs on different hosts**
English Name	Scientific name	
Mango	*Mangifera indica*	100
Kaki	*Diospyros kaki*	100
Plum	*Prunus domestica*	77.8
Casuarina	*Casuarina equisitifolia*	62.0
Berry	*Morus alba*	56.8
Glosbe	*Citrus aurantium*	40.0
Pear	*Pyrus Communis*	20.9
Pomegranate	*Punica granatum*	20.0
Guava	*Psidium guajava*	0.0
Olive	*Oleaeur opaea*	0.0
All tested hosts without inoculation	Control	0.0

Fig.(6): Artificial inoculation with *Ganoderma* sp. on discs of woody stems of different host ranges *in vitro* , at 25 °C , 15 days after inoculations .

1- Effect of carbon and nitrogen sources on the mycelial growth of *Ganoderma* sp. at 25 ^{o}C :

A - Effect of Carbon sources: Effect of carbon source on the mycelial growth of *Ganoderma* sp. incubated at 25 ^{o}C for 10 days are shown in Table (2). Data indicated that starch and mannose used as carbon source recorded a noticeable increase in the linear growth of the fungus under study followed by sucrose, maltose and manitol. It can be observed that starch gave the best linear growth (82.4 mm/10 days) as carbon sources. In the same time, fructose followed by glucose and Lactose recorded moderately fungal growth. However, lactic acid and oxalic acid showed the least amounts of the fungal growth, in this respect as compared with the control without carbon sources. It was found that the fungal growth on different carbon sources varied between each other's. This study was conducted to determine the effect of culture media on the growth rate in *Ganoderma* sp. Jeong *et al*., (2005) reported that the optimum carbon source for the growth of *G. applanatum* was glucose. Jayasinghe *et al*., (2008) reported that dextrin was the best carbon source for the mycelial growth of *G. lucidum*. Griffin, (1994) who stated that mannose and fructose were the most commonly utilized sugars after glucose.

Table (2): Effect of carbon source on the mycelial growth of *Ganoderma* sp. at 25^{o}C.

Carbon sources	Colony diameter (mm/10 days).*			
	El-Karakrah Iso. 1	Abo-Kharwae Iso.2	El-Wasfia Iso.2	Mean of all isolates (mm/days)
Starch	86	81	80.3	82.4
Mannose	80	78.3	75.25	77.85
Sucrose	77.7	76.33	74	73.01
Maltose	73.7	71.3	70.30	71.77
Manitol	71.3	70	69.26	70.19
Fructose	67.33	66	65	66.11
Glucose	66	64.67	62. 23	64.34
Lactose	62	61.3	61	61.43
Lactic acid	59	58	57.30	58.1
Oxalic acid	58	57.67	56	57.22
Control	39.67	38.33	37.67	38.56
LSD 5%	5.05	7.38	5.25	

***: Mean of 3 replicates**

B- Effect of favorable nitrogen sources: Effect of nitrogen source on the mycelial growth of *Ganoderma* sp. incubated at 25 ^{o}C for 10 days are shown in Table (3). Data indicate that The tested fungus gave maximum growth rate on Yeast extract 10 days after incubation at 25 ^{o}C followed by Molt extract, Peptone and Ammonium sulphate which found to be the best sources of nitrogen for *Ganoderma* sp. Yeast extract was the best nitrogen source for growing *Ganoderma* sp. giving 85.22 mm /linear growth after 10 days, while urea gave the lowest growth 41.99 mm/ linear growth after 10 days. In the same time, Ammonium nitrate, Ammonium chloride, Ammonium acetate,

Calcium nitrate, Potassium nitrate and Sodium nitrate recorded medium fungal growth ranged from 45 to 63 mm/linear growth. The high growth on peptone among nitrogen compounds may be attributed to its being a complex mixture of peptides and amino acids containing some water –soluble vitamins Hussain *et al.,* (2003). However, the lower growth rate was recorded on Urea, Sodium nitrate and Potassium nitrate. In this respect In the same time, Jeong *et al.,* (2005) reported that the optimum nitrogen source for the culture of G. *applanatum* was corn steep power (10%).

Table (3): Effect of different nitrogen sources on mycelial growth (mm) of *Ganoderma* sp. incubated at 25 °C for 10 days.

Nitrogen sources	Colony diameter (mm/10 days).*			Mean
	El-Karakrah Iso. 1	Abo-Kharwae Iso.2	El-Wasfia Iso.2	
Yeast extract	86.67	85	84	85.22
Multextrct	81.33	80	77.67	79.67
Pepeton	78	77.3	77	77.43
Amonium sulphate	74	72.33	71	72.44
Amonium nitrate	66	62	61.67	64.56
Amonoium chloride	62	61	59	60.67
Amonoium acetae	59.67	56	53.3	56.35
Calcium nitrate	54	52.3	51	52.43
Potssium nitrate	49.3	47.67	46.3	47.76
Sodium nitrate	46.76	45.3	44.3	45.45
Urea	43	42.3	40.67	41.99
Control	34.67	33.67	32.33	33.56
LSD at 5%	6.58	5.59	3.88	

***: Mean of 3 replicates**

Effect of different temperature degrees on the fungal growth *in vitro*:

The growth of the *Ganoderma* sp. was evaluated at temperatures 10, 15, 20.25,30 and 35°C. The obtained results in Table (4) indicate that the optimum temperature for the linear growth of *Ganoderma* sp. ranged from 20 to 30 °C. The maximum average temperature for the fungal linear growth was30 °C followed by 25 and 20 °C. The lowest temperature for the linear growth of the fungus was10°C, however, 15 and 35 °C recorded lower linear growth of *Ganoderma* sp. . It is appear that temperature ranged from 20-30 ˚C which is common in Egypt approximately all over the year are suitable and favorable to infect mango seedling and establish trees with *Ganoderma* sp through wounds and mechanical injeries. In this respect, Song *et al*., (2007) observed that *G. lucidum* had maximum mycelial growth rate at 25-35˚C. Similar results were also obtained by Negi *et al*., (2008) who reported that the optimum temperature of 32 ± 2˚C for the growth of *G. lucidum*. In the same time, Mishra and Singh (2010) revealed that local isolates of *G. lucidum* preferred 25-30˚C temperature and malt extract agar medium for their growth.

Table (4): Effect of different temperature on mycelial growth (mm) of *Ganoderma* sp., 10 days after inoculation.

Temperature(°C)	Liner growth (mm /10days)for 3 isolates of *Ganoderma* sp.*			Mean
	(El-Karakrah) Iso1	(Abo-Kharwae) Iso2	(El-Wasfia) Iso3	
10	10.22	8.11	6.70	8.34
15	28.30	21.22	18.66	22.73
20	58.36	51.69	49.92	53.32
25	85.64	78.39	76.13	80.1
30	87.30	82.90	83.19	84.46
35	26.11	28	25.07	26.39

***= Mean of 3 replicates.**

Biological control (Antagonistic effect against *Ganoderma* sp. :)

Data presented in Table (5) indicate that *T. harzianium* recorded the highest percentage of inhibition against *Ganoderma sp.* followed by *T. virens*. However, *Chaetomium globosum* showed the lower percentage of inhibition(Fig.7) . This trend was observed with the 3 isolates under study. Srinivasulu *et al*., (2008) studied the effect of volatile and non-volatile metabolites of *Trichoderma* spp. on *Ganoderma* spp. This metabolites were specific to control the *Ganoderma* spp. They also reported that volatile metabolites showed positive correlation between the inhibition of radial growth of *Ganoderma* spp. and the age of *Trichoderma* spp. Ogbebor *et al*.,(2010) also reported that fungi antagonist obtained from rubber plantations were screened and found antagonistic to *Ganoderma psuedoferreum* . *Trichoderma* and *Aspergillus* species screened were found antagonistic to the pathogen.

Table (5): Effect of three antagonistic fungi on three isolates of *Ganoderma* sp. the causal organism of white rot disease on mango trees in *vitro.*

Bioagents	% inhibition on the 3 isolates of *Ganoderma* sp.			Mean
	(El-Karakrah) Isolate1	(Abo-Kharwae) Isolate2	(El-Wasfia) Isolate3	
T.harzianium	76.54*	72.40	77.55	75.49
T.virens	75.42	69.30	75.67	73.46
Chaetomium globosum	60.33	55.43	51.99	54.99

***Mean of three replicates.**

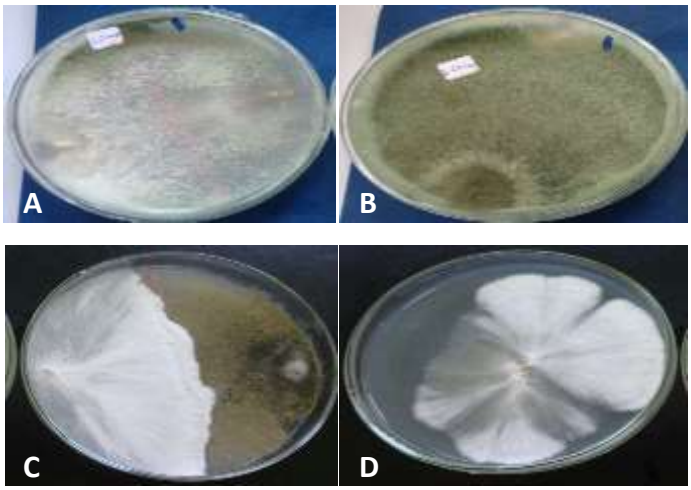

Fig. (7): Antagonistic effect of *Trichoderma harzianium* (A),*T. viren* (B)and *Chaetomium globosum* (C) against *Ganoderma* sp. compared with the control (D).

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مرض جديد يصيب قاعدة جذوع اشجار المانجو يتسبب عن الاصابة بالفطر في مصر *Ganoderma* sp.

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خلال السنوات الاخيرة ظهرت اعراض مرض جديد علي اشجار المانجو بمحافظة الاسماعلية ومنها تم عزل الفطر *Ganoderma* sp . تبدا اعراض الاصابة بعفن ينمو علي الجزء القاعدي لاشجار المانجو يتبعه نموتراكيب مميزة تعرف باسم بالثمار البازيدية والتي تؤدي في النهاية الي موت الاشجار . ثلاثة مزارع لفطر *Ganoderma* sp تم عزلها من اشجار مانجو مصابة من ثلاث مزارع بمركز ابو صوير (القارقرة – ابوخروع – الوصفية) محافظة الاسماعلية وذلك لاول مرة في مصر . الفحص الميكروسكوبي للعزلات النقية اوضح ان الجهازالميسليومي المقسم للفطريظهر وجود ثلاثة انواع من الهيفات نوع يظهر به هيفات مقسمة ونوعيين غير مقسمة و جراثيم بازيدية وجراثيم كلاميدية.

اوضحت نتائج العدوي الصناعية علي شتلات مانجو عمرها سنتين ان عزلة الفطر*Ganoderma* sp المعزولة من منطقة القارقرة ادت الي موت الشتلات المحقونة بالفطر بعد شهر من اجراء العدوي الصناعية بالتربة وذلك تحت ظروف الصوبة الزراعية بمزرعة كلية الزراعة بالاسماعلية .

كما اوضحت تجارب العدوي الصناعية لدراسة المدي العوائلي لهذا الفطر علي اقراص خشبية قطرها من 2-3 سم وارتفاعها 1سم لعشرة انواع من الاشجار الخشبية ان الفطر قادر علي اصابة اشجار المانجو والكاكي بنسبة 100% وذلك بعد اسبوع من العدوي والتحضين علي درجة 25 درجة مئوية وعلي العكس من ذلك فان الفطر لم ينجح في اصابة اقراص خشبية من اشجارالزيتون والجوافة بينما اظهر الفطر قدرة مرضية متوسطة علي اصابة كل من البرقوق والكازوارينا والتوت حيث بلغت الاصابة علي التوالي 77,8 و62و56,8 % .

استخدام عشرة مصادر مختلفة للكربون وتاثيرها علي نمو الفطر بالمعمل اوضح ان النشا وسكر المانوز قد سجلا زيادة واضحة في نمو الفطر علي تشابك دوكس يليه السكروز والمالتوز وكحول المانيتول .بينما اوضح استخدام 11 مصدر من مصادر النيتروجين ان مستخلص الخميرة ادي الي زيادة نمو الفطر عند استخدامه كمصدر للنيتروجين بالبيئة الصناعية يليه مستخلص المولت والبيتون وسلفات الامونيوم حيث اوضحت انها افضل المصادر الازوتية لاحتياج نمو الفطر *Ganoderma* sp علي البيئة الصناعية.

وكذلك اوضحت النتائج ان درجة الحرارة المثلي لنمو الفطر تتراوح ما بين 20-30 درجة مئوية .الفطر المضاد *Trichoderma harzianum* سجل اعلي نسبة مئوية للتضاد مع الفطر الممرض يليه الفطر *Trichoderma virens* علي الوجه الاخر حقق الفطر *Chaetomium globosum* اقل نسبة مئوية للتضاد مع المسبب المرضي.

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