climate change is real: fungal perspective in MENA

By

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1 Introduction

- Many studies in recent years have investigated the effects of climate change on the future of biodiversity. Predicting the response of biodiversity to climate change has become an extremely active field of research carried by several investigators.
- Predictions play an important role in alerting scientists and decision makers to potential future risks, provide a means to bolster attribution of biological changes to climate change and can support the development of proactive strategies to reduce climate change impacts on biodiversity.

Climate Change and its Impact

***The word climate refers to the weather variation of any specific area over a period of time. Climate includes:**

- the average temperature,
- amount of precipitation,
- days of sunlight, and other variables that might be measured at any

  given site.
- However, there are also changes within the Earth's environment that can affect the climate .

Climate change

- refers to any change in the environment due to human activities or as a result of natural processes.
- refers to significant and long-term changes to a region's climate. These changes can occur over a few decades, or millions of years.
- alters entire ecosystems along with all of the plants and animals that live there.

▪ Indicator of Climate Change

- Earth's climate has gone through different changes and it is now unquestionable that it is warming at an increasing rate. These adverse changes, greatly due to human activities, have seen an increase after the industrial revolution and have been happening for several reasons, such as increasing concentrations of greenhouse gases (water vapor, carbon dioxide, methane and nitrous oxide) and of particulate matter in the atmosphere.

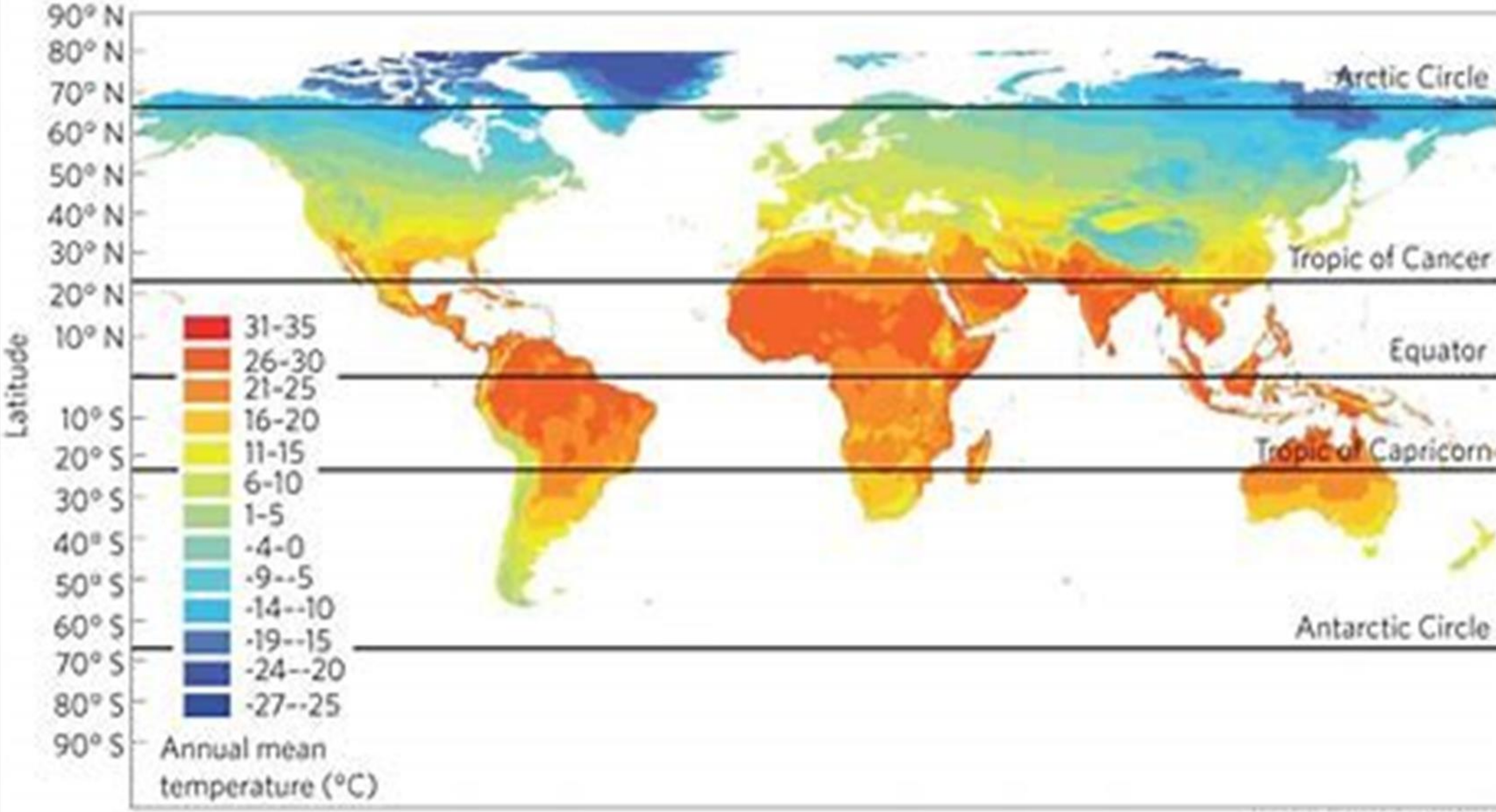
- Over the last few decades, we’ve been witnessing the warming of the atmosphere and the ocean, the decrease of snow and ice, droughts, and the rise of sea levels and changes in its temperature, salinity and nutrient availability.

- All of these factors generate a domino effect, impacting all living beings and systems. Even though policy-makers are now aware of the current evolution and thoughtful actions have been designed to reduce negative effects, more efforts are needed to better understand and circumvent

The state of the climate in Africa in 2021 & UN Climate Change News, 27 October 2020 as depicted in this report

- Africa characterized by continued warming temperatures, rising sea levels and impacts associated with extreme weather and climate events. It constitutes a snapshot within a continuum of rapidly rising longer-term climate-related risks associated with global warming.

- Africa is therefore an exposure and vulnerability "hot spot" for climate variability and change impacts. Projections under Intergovernmental Panel on Climate Change (IPCC) Representative Concentration Pathway (RCP) 8.5 suggest that warming scenarios will have devastating effects on crop production and food security.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Tropic of Capricorn
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31-35
26-30
21-25
16-20
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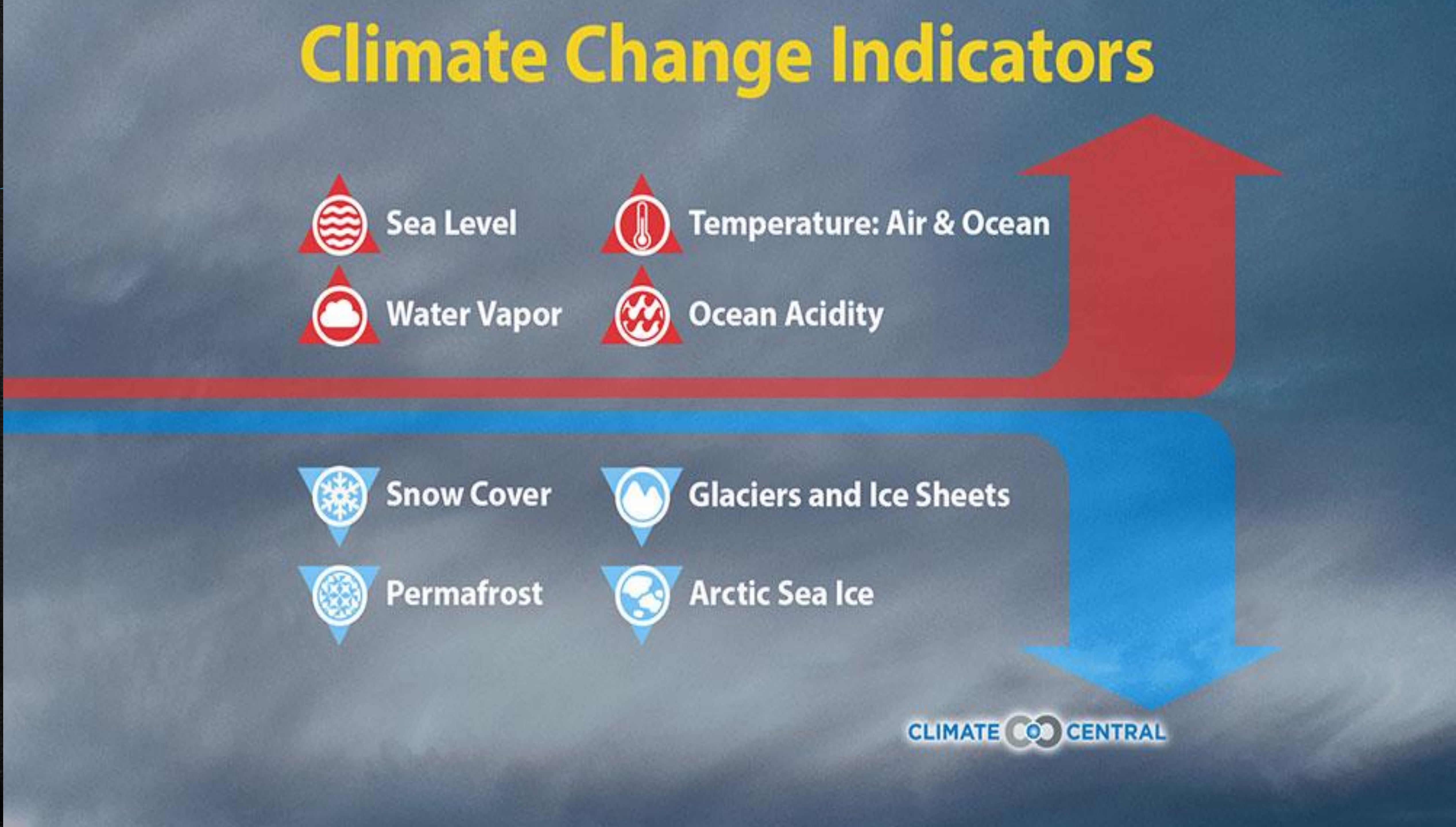
-9--5
-14--10
-19--15
-24--20
-27--25
Annual mean temperature (°C)


Climate Change Indicators
Sea Level
Temperature: Air & Ocean
Water Vapor
Ocean Acidity
Snow Cover
Glaciers and Ice Sheets
Permafrost
Arctic Sea Ice
CLIMATE CENTRAL

- Egypt is located in northern Africa, bordering the Mediterranean Sea between Libya and Gaza strip, with a coastal strip extending for about 3,500 kilometers, overlooking the Mediterranean Sea in the north, and the Red Sea in the east.

- Egypt’s climate is semi-desert characterized by hot dry summers, moderate winters and very little rainfall. The country is characterized by particularly good wind regimes with excellent sites along the Red Sea and Mediterranean coasts.

- Egypt has only one main source of water supply, the River Nile, which supplies over 95% of the water needs of the country. There is some winter rain in the delta and along the Mediterranean coast, west of the delta.

- The Nile waters originate outside Egypt, flowing through nine countries. Egypt’s use of the Nile water is controlled by international agreement. Massive projects to divert some of the Nile waters to Northern Sinai, and to Toshka depression, in the extreme south of the country, are underway. Consequently, the water needs of the country are growing rapidly.

- Studies have shown that Egypt’s climate has changed greatly over the last 10,000 years, changing gradually from a wet climate (rainfall was more than 300 mm/year) to a more arid climate (less than 50 mm/year).

- **Egypt’s Nile Delta** is a globally important but critically endangered ecoregion, threatened by climate change, habitat destruction, pollution and increased salinity.

- Its ecosystems could not exist without fungi as symbionts and recyclers, and they face the same threats as the animals and plants, which depend on them.

Why fungi are important?

- The fungi are a huge assemblage of organisms.
- Best current estimates suggest there are around 1.5 million species worldwide, of which only about 5% have so far been discovered. That means around 95% are still unknown.
- Fungi comprise one of the great kingdoms of biology - the others include the animals, bacteria, plants and protozoa.
- Fungi are totally different from all of those. They are found in all main freshwater, marine and terrestrial ecosystems.
- The most obvious impacts fungi have on human life are as foodstuffs (for example yeast, which is a fungus, is essential for making bread and alcoholic drinks), antibiotics (penicillin, for example, is a fungal product), and through diseases of crops and domesticated animals. But their real impact, although less obvious, is actually much greater.
- They are phenomenally important, providing key ecosystem services, for example as recyclers of nutrients, and without fungi life on this planet could not be sustained.

- Fungi are eukaryotic organisms ubiquitous on Earth. They can convert organic matter into carbon dioxide and small molecules – as decomposers; they can colonise plants, solubilising and delivering phosphorous, nitrogen, micronutrients and water – mycorrhizal; and they can cause disease in other beings – pathogens.
- Fungi are affected both directly and through the effects of organisms they are associated with. Since fungi play fundamental roles in nutrient cycling and exchange, and regulate key ecosystem processes, it is essential to understand how they are affected by such a large-scale event.

How many species of fungi in Egypt?

- Abdel-Azeem (2020) recorded 2477 species of fungi in Egypt, a figure apparently exceeding that of the higher plants developing in this country. This marked figure resulted from an exhaustive revision of all the existing literature and information sources established since the year 1813 up to the middle of the current one by Abdel-Azeem.

- On the kingdom level, the group Fungi comes first by its 2230 species; this is followed by the Chromistan fungal analogues (186) and the less provided Protozoan fungal analogues: 61. The Ascomycota form the major largest group within this checklist with about 1762 species; among the latter 158 units are lichen-forming and about 1000 are still presently known only by their conidial (asexual) states. The remaining recorded units are distributed in the following manner: 90 Chytridiomycota, 27 Blastocladiomycota, 70 Zygomycota, 48 Glomeromycota, and 233 to Basidiomycota.

Numbers of recorded Egyptian fungi.

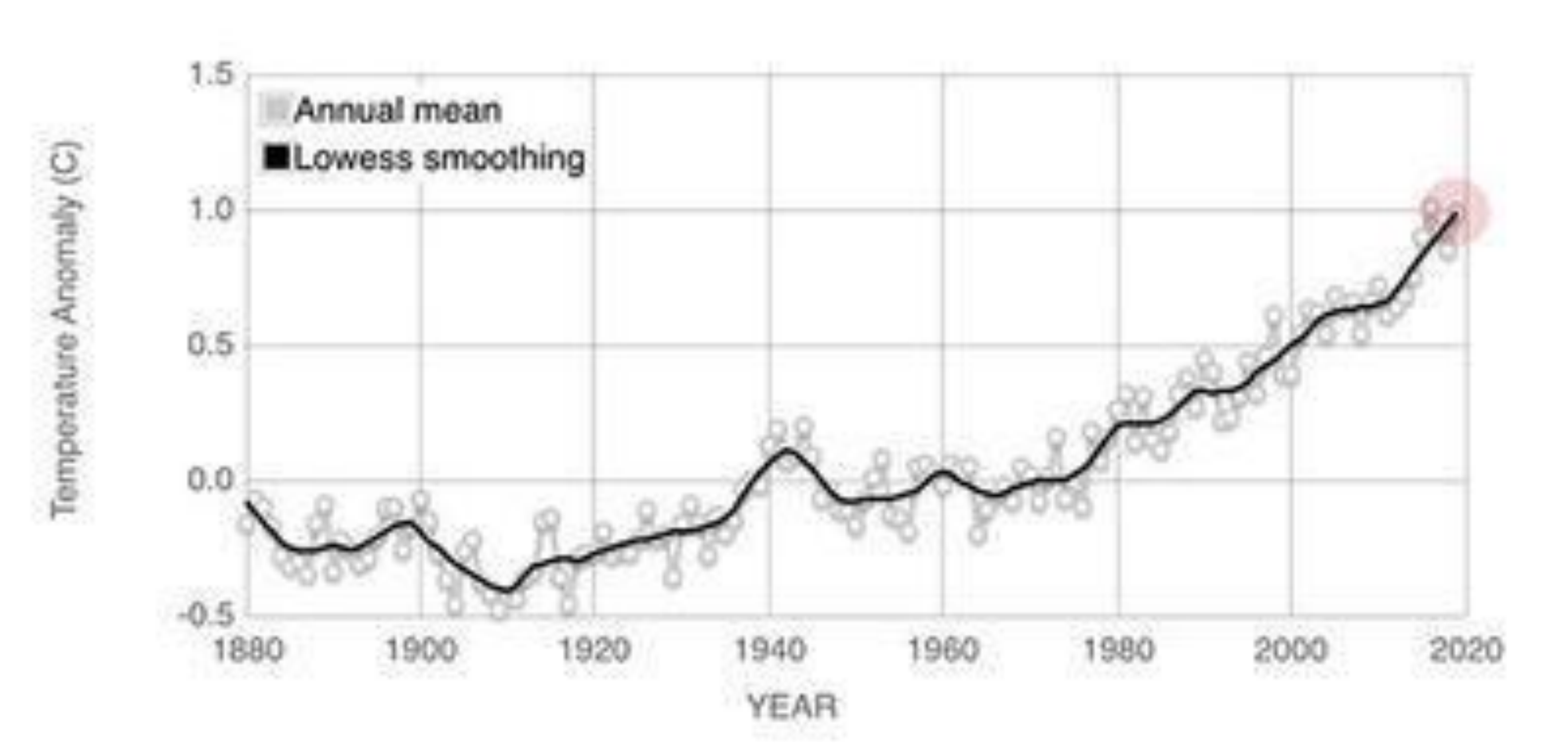
Groups and Phyla		El-Abyad (1997)	Present survey
Protozoan fungal analogues	*Amoebozoa*	0	25
	Cercozoa	0	3
Chromistan fungal analogues	*Hyphochytriomycota*	1	3
	Labyrinthista	0	2
	Oomycota	25	157
	Incertae sedis	0	1
Blastocladiomycota		3	24
Chytridiomycota		21	69
Zygomycota		17	53
Glomeromycota		0	48
Ascomycota	Teleomorphic genera	80	251
	Anamorphic genera	181	261
Basidiomycota		32	201
Total no. of genera recorded in Egypt		360	755
Total no. of species recorded in Egypt		1246	2281

KEY UNRESOLVED QUESTIONS

- What is the relative importance of fungal adaptation, migration and acclimatisation?
- How does climate change affect the yield of fungal spore-bearing structures?
- How does climate change affect fungal growth and activity?
- How do fungi mediate ecosystem responses to climate change?
- How do changes in the phenology of sporebearing structure production reflect changes in activity, abundance, biomass and distribution?
- Can fungi track climate space shifts?

Global impacted areas: a fungal perspective

- The effect of climate changes on fungi will, directly and indirectly, affect many areas. Here are some examples:



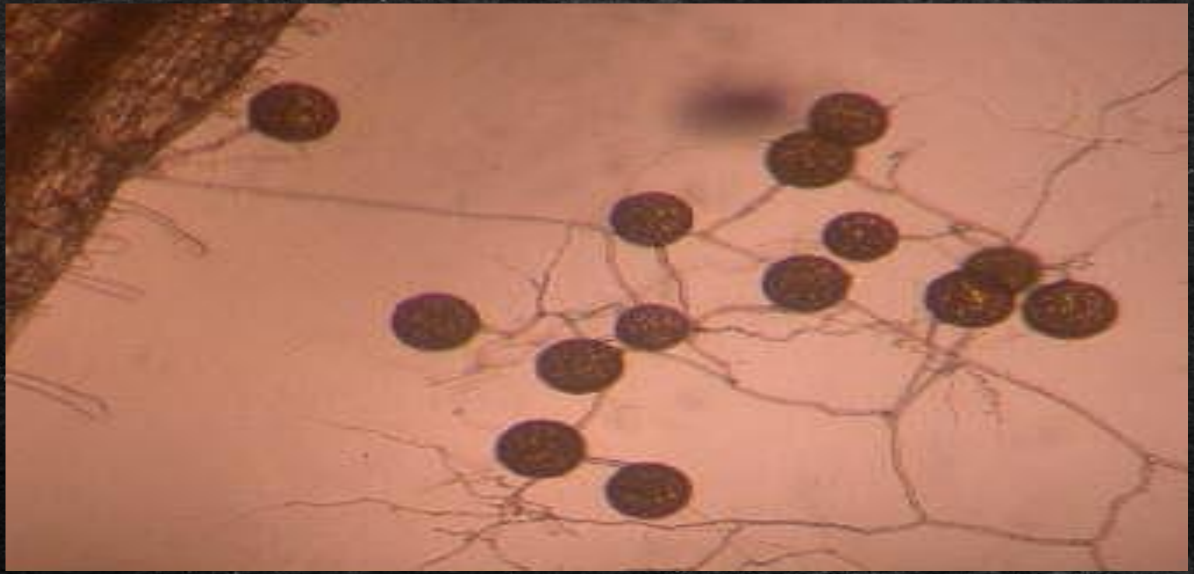
- terrestrial plants benefit from being associated with mycorrhizal fungi. Plant-associated fungi play key roles in the plants’ development .

Chemical composition, pH, water content and organic matter are just some of the abiotic factors that characterise soils. These, called edaphic factors, are influenced by climate and influence several organisms such as fungal communities, causing biodiversity changes. Furthermore, abiotic stressors (e.g. increased temperature, salinity or carbon dioxide concentrations and changes in water availability), which increase with climate change, disrupt mycorrhizal associations and can, in turn, influence vital agricultural aspects like irrigation requirements, crop rotations, optimal crop timing and the propensity for crop contamination with fungal phytopathogens.

- fungi associated with trees, rather than seedlings Fungal response and effect traits Data from multiple simultaneous drivers of change (nitrogen deposition, carbon dioxide, ozone, UV, temperature, drought, fire)

Arbuscular Mycorrhizal (AM) Symbiosis and Improving soil Fertility Subjected to Salt Stress

Gamal. M. Abdel-Fattah Ouf



Arbuscular mycorrhizal (AM) fungus *Glomus intraradices* propagated using the *in vitro* caroot root

Glomus clarum SA3

Glomus mosseae SA12

Glomus aggregatum SA2

Gigaspora sp. SA18

Gigaspora gergaria SA8

Glomus versiforme SA6

Gigaspora rosea SA1

Glomus sp. SA19

Gigaspora coralloidca SA10

وظائف فطريات الميكروهيزا فى النبات

1- mycorrhizal fungi improve growth and yield of associated plants by stimulating nutrient uptake, phytohormone productions, increasing root surface particularly in non fertile soils.

1- لها دور هام في زيادة نمو وإنتاجية النباتات المصاحبة لها من خلال تحسين انتقال العناصر الغذائية وإنتاج بعض منظمات النمو، وكذلك زيادة مسطح امتصاص الجذور.

2-Increase in organic and inorganic phosphorus uptake

2- زيادة معدلات الفسفور العضوي وغير العضوي داخل النبات

plants 3- Mycorrhizal fungi can increase drought resistance of

3- التغلب علي مشاكل الإجهاد المائي ونقص المياه في النباتات المصاحبة لها

4- Mycorrhiza formation stimulates nodulation and nitrogen fixation

4- تشجيع معدل تكوين العقد البكتيرية وزيادة المحتوي النيتروجيني للنبات

5- Mycorrhizal fungi protect crop, horticultural and agricultural host plants against salinity

5- حماية النباتات المصاحبة لها من الآثار الضارة للملوحة

6- Mycorrhizal fungi may play an important role in increasing heavy metal tolerance of plants

6- تزيد قدرة النباتات المصاحبة لها على التخلص أو تحمل سمية العناصر الثقيلة

7- Arbuscular mycorrhizal (AM) fungi can stimulate plant growth and productivity under stress condition

7- زيادة معدلات نمو وإنتاجية النباتات المصاحبة لها وبصفة خاصة تحت الإجهاد

8- Mycorrhizal fungi act as a biological control agent against the plant pathogens

8- تستخدم كمبيدات حيوية آمنة للتخلص من معظم الأمراض النباتية (البكتريا – النيماتودا – الفيروسات – الحشرات – الفطريات)

9- Soil hyphae are likely to have an important role in nutrient cycling

9- هيفات هذه الفطريات لها دور حيوي في تدوير المركبات الغذائية

10- Hyphae of AM fungi are considered to contribute to soil fertility (Glomalin) and structure by increasing soil aggregates and their stability

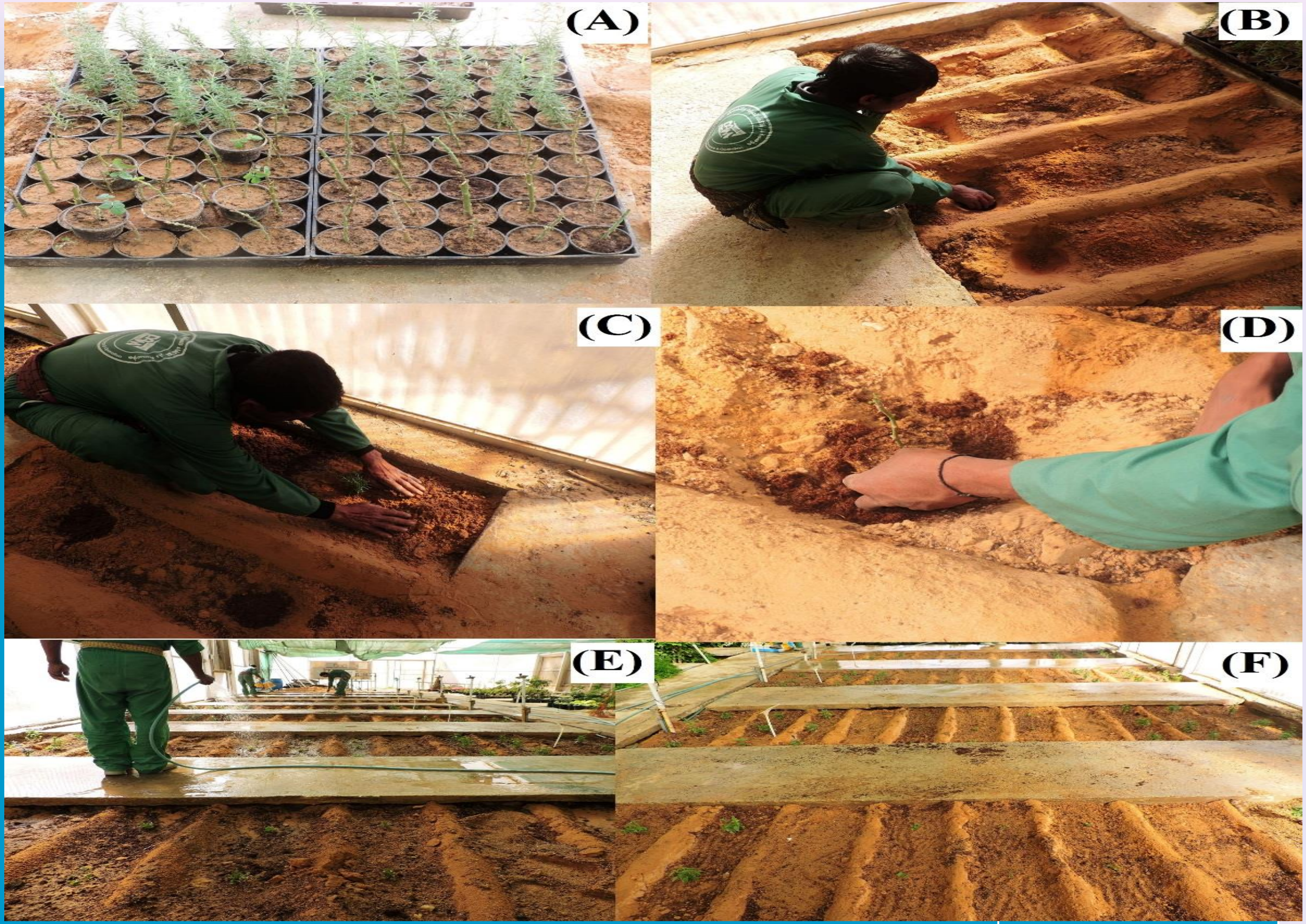
10- زيادة خصوبة التربة من خلال إفراز أنواع خاصة من البروتينات مثل الجلومالين (مادة عضوية غروية معقدة تساعد علي ربط حبيبات التربة مما يساعد على تحسين بناء التربة وقوة مسكها للماء والعناصر الغذائية) بالإضافة إلي تثبيت الرمال المتحركة ومكافحة التصحر .

11- Mycorrhizal fungi contribute to carbon storage in soil by altering the quality and quantity of soil organic matter

11- تساهم هذه الفطريات في تحليل المواد الكربونية المعقدة التي تؤدى إلى زيادة خصوبة الثرية.

12- Mycorrhizas influence soil microbial populations and exudates in the mycorrhizosphere and hyphosphere

12- تساعد علي زيادة المجتمعات الميكروبية النافعة في الترب، خاصة في منطقة الريزوسفيروالريزوبلان.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إعداد التربة وأنابيب الري لزراعة نباتات الطماطم Tomato (*Lycopersicum esculantum*) في البيوت المحمية النامية تحت تأثير الملوحة والتسميد الحيوى بالميكرويزا

إضافة سماد فطر الميكروهيزا الشجيري (*Glomus deserticola*) الحيوي إلي نباتات الطماطم (*Lycopersicum esculantum*) في البيوت المحمية

تأثير فطر الميكوريزي الشجيري (*Glomus deserticola*) علي نمو وإنتاجية نباتات الطماطم Tomato (*Lycopersicum esculantum*) في البيوت المحمية

Mycorrhizal fungi and soil salinity

Arbuscular mycorrhizal (AM) fungi play an important role for plant protection against salt stress, via different mechanisms as follows:-

1- Increasing osmotic pressure in cells of mycorrhizal plants by increasing metabolic materials such as carbohydrates and amino acids like proline.

2- Improving plant water relations (morphogenetic changes by increasing number of adventitious roots).

3- Producing cytokinin-like substances in roots and leaves in colonized mycorrhizal plants.

4- Improving nutrient absorption; specially P, N, K and Zn.

5- Adjusting transpiration rate and stomatal conductance. Moreover, increasing water relations of associated plants.

التسميد الحيوي بالميكروهيزا

1- زيادة خصوبة التربة بالاضافة الي تحسين انتاجية الزهور لنبات (الكلانشو) تحت ظروف الجفاف

Kalancho blossfeidiana Poelin

Asrar et al., 2011)

2- زيادة قدرة النبات (الماري جولد)

Marigold (*Tagetes erecta*)

علي تحمل الجفاف وزيادة انتاجية الزهور.

Asrar and Elhindi, 2010)

Mycorrhizal fungi and drought stress

The mechanisms of the arbuscular mycorrhizal (AM) symbiosis to protect drought resistance and increase plant tolerant

1- Extensive absorption of water by external hyphae (Ruiz-Lozano and Azcon, 1995; Cho et al., 2006).

2- A greater osmotic adjustment in mycorrhizal plants which promotes turgor maintenance even at low tissue water potential (Auge et al., 1986; Porcel and Ruiz-Lozano, 2004).

3- Osmotic adjustment which promotes turgor maintenance even at low tissue water potential (Auge et al., 1986), increased photosynthetic activity, proline and carbohydrate accumulation.

4- Enhanced water uptake at low soil moisture levels as a result of extraradical hyphae (Fagbola et al., 2001).

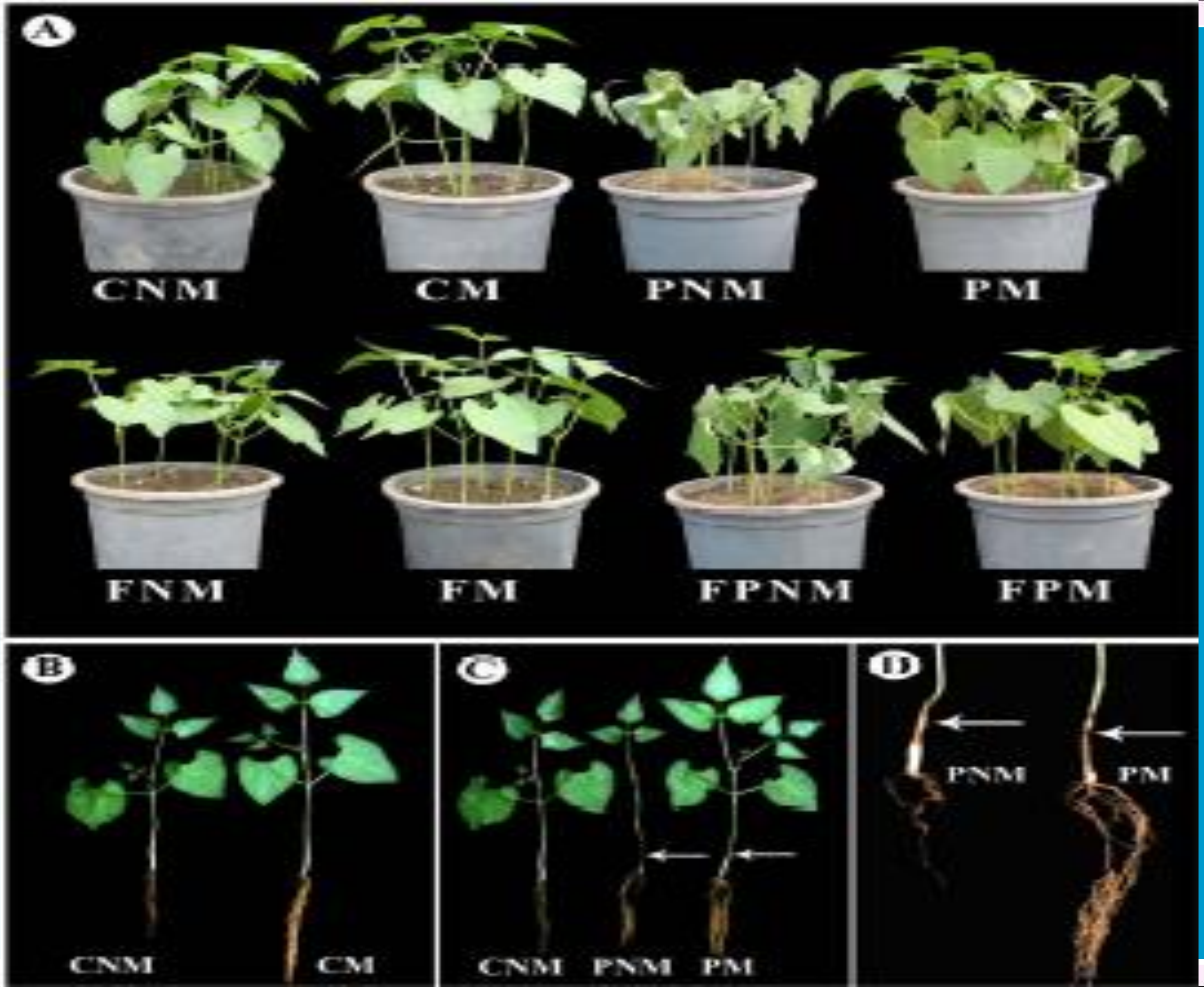
5- Possible mechanisms for improving drought resistance of the mycorrhizal plants could be due to an increased in root hydraulic conductivity (Robert et al., 2008), stomatal regulation or transpiration rate (Allen and Boosalis, 1983).

Mycorrhizal fungi and biological control of pathogenic organisms

It is well established that the addition of mycorrhizal fungi together with the plant pathogen reduced the impact of the pathogens. Several specific mechanisms of resistance against parasitic soil borne pathogens by the mycorrhizal fungi were reported as follows:-

1- Mycorrhizal roots are more lignified and contained more polysaccharides than non-mycorrhizal ones, especially in the stellar tissue (Dehne and Schonbeck, 1979; Abdel-Fattah et al., 2011).

2- Production of inhibitory phenolic compounds (Morandi, 1989; Abdel-Fattah and Mankarius, 1992) by mycorrhizal fungi or their host play a role in the plant protection mechanism against pathogenic microbes.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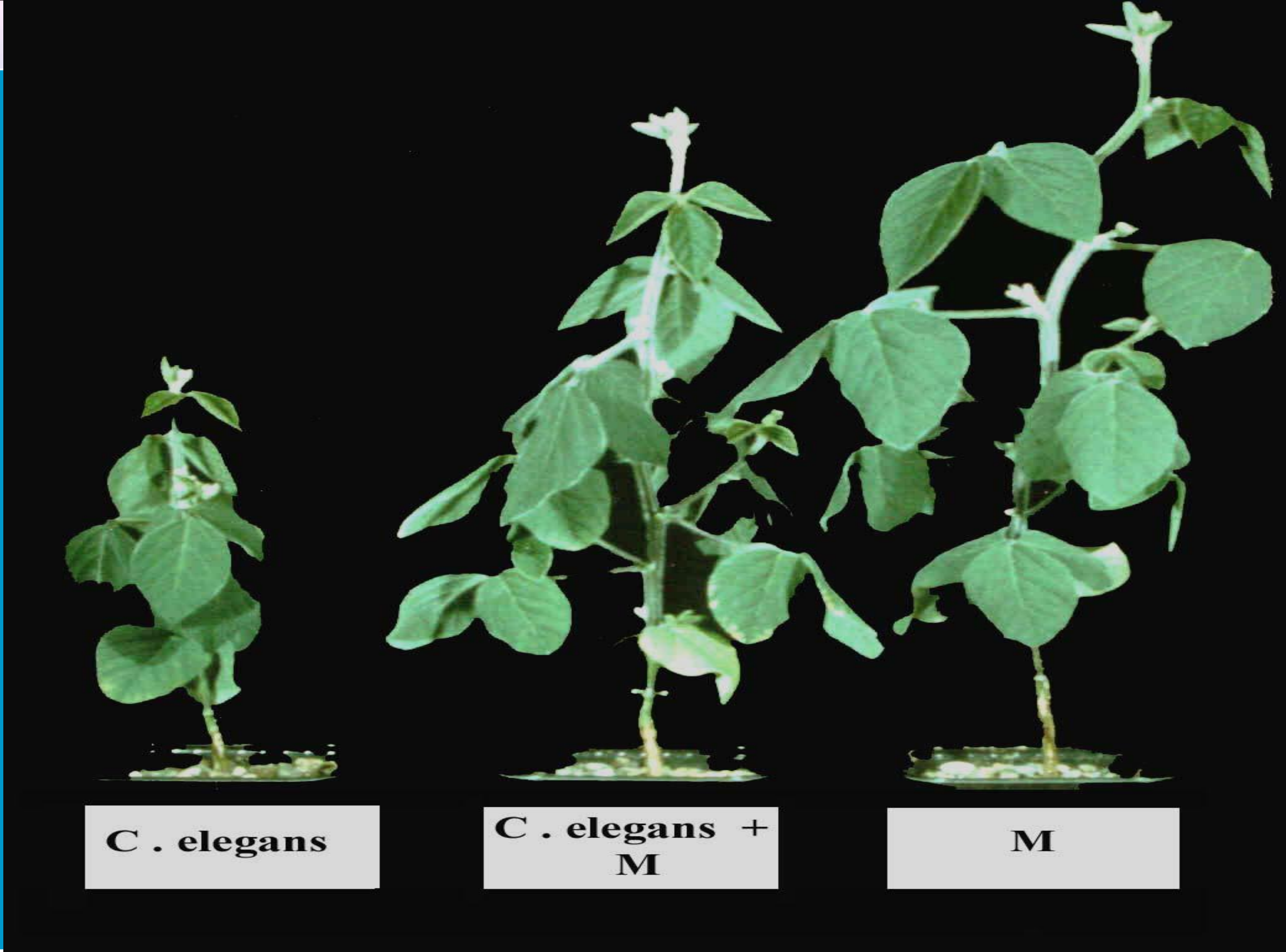
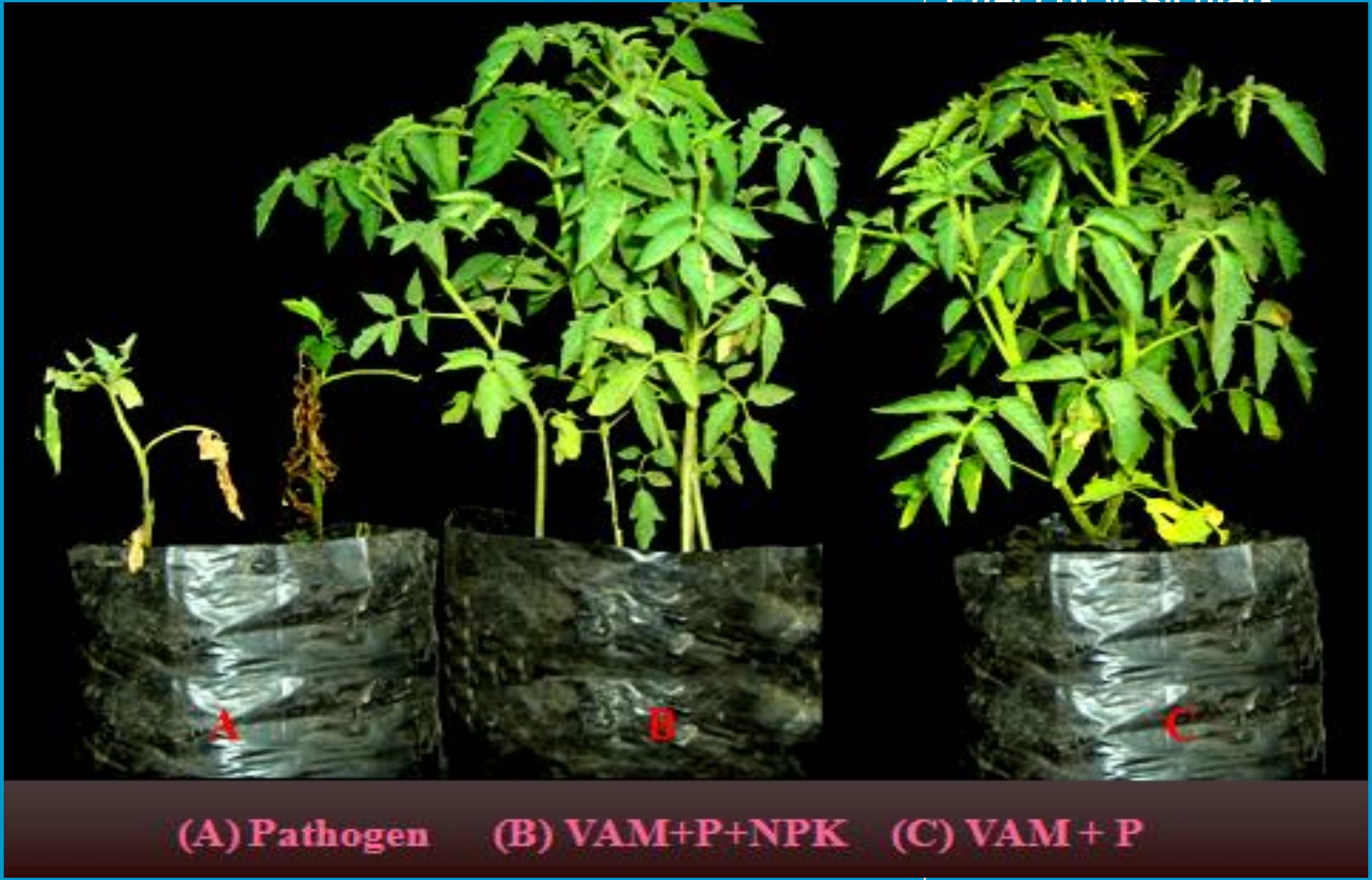


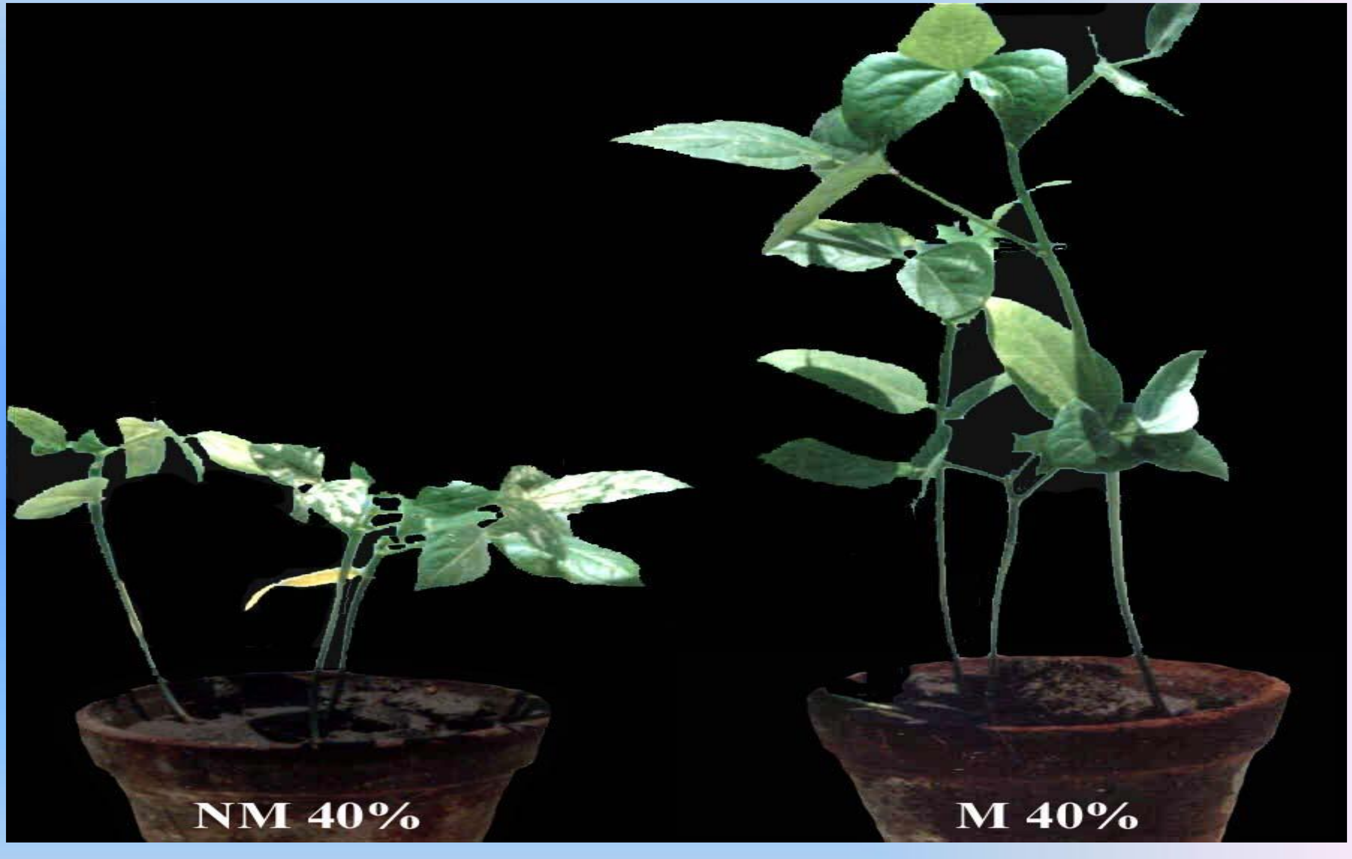
C . elegans
C . elegans +
M
M

Effect of Vesicular-



Mycorrhizal fungi and remediation of organic and inorganic pollutants in contaminated soil

- دور فطريات الميكروهيزا فى حماية نبات البسلة من الاثار الضارة من العناصر الثقيلة الموجودة في مخلفات مياه الصرف الصحي (أعادة استخدام مياه الصرف الصحى بعد معالجتها بيولوجيا باستخدام فطريات الميكروهيزا)



Alleviation of water sewage toxicity by mycorrhizal fungi (Abdel-Fattah and Rabie, 2005)

The mechanisms of the arbuscular mycorrhizal (AM) symbiosis to alleviate soil heavy metals and organic pollutants and increase plant tolerance

The AM fungi may play a significant role in soil remediation by enhancing metal removal from contaminated soil and protecting host plants against metal toxicity by:-

1- Retention and immobilization of metals in chitin or glomalin in the fungal cells (Khan et al., 2000; Gonzalez-Chavez et al., 2004) and reduced metal transfer from roots to shoots (Christie et al., 2004).

2- AMF increase soil pH in the rhizosphere and make metals less available for plant uptake (Kabata-Pendias and Pandias, 2001, Audet and Charest, 2006).

3- AM fungi could increase the activity of enzymes in soil, thereby enhance the degradation of organic pollutants (Liu et al., 2004; Tang et al., 2009; Wang et al., 2009.

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The mechanisms of the arbuscular mycorrhizal (AM) symbiosis to alleviate soil heavy metals and organic pollutants and increase plant tolerance

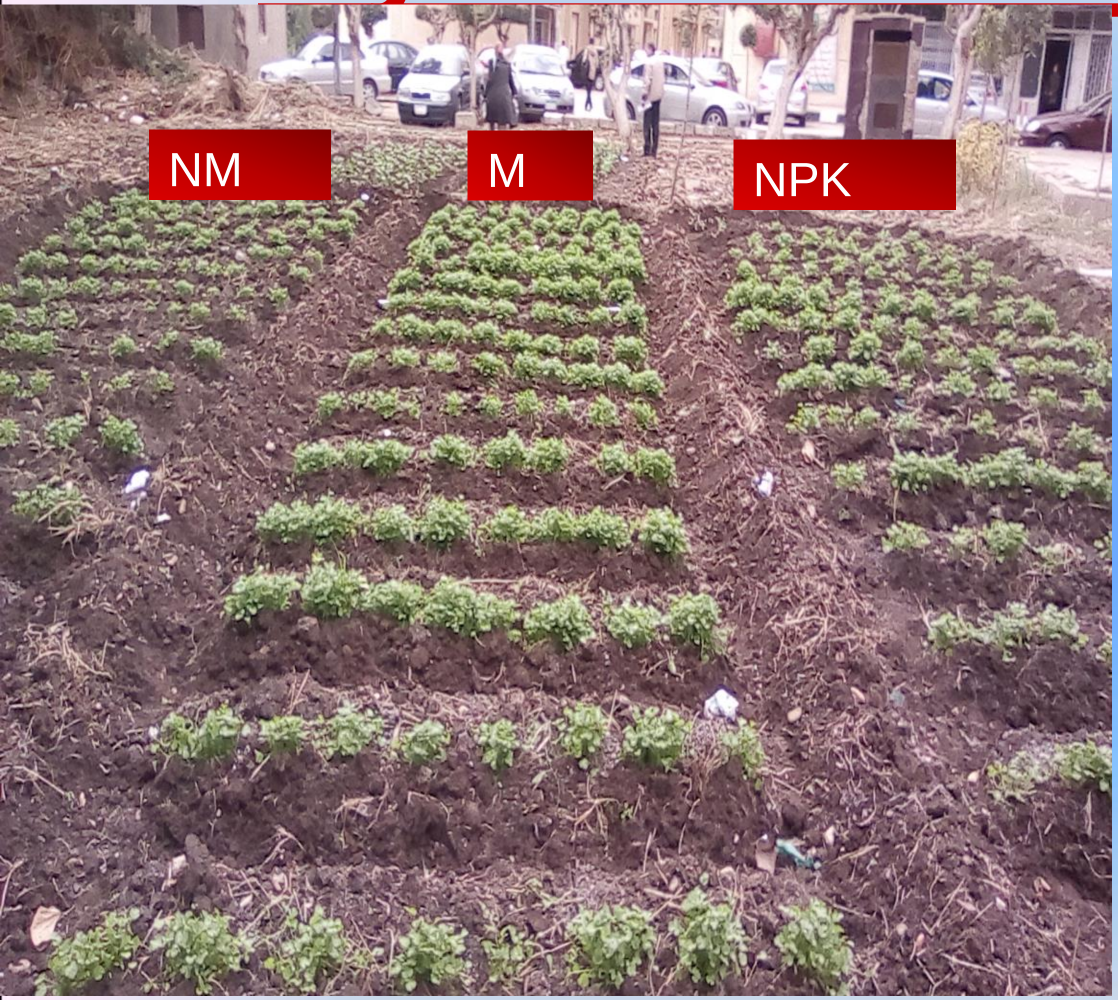
3- The mycorrhiza increase plant biomass and thus dilute metals in plant tissues (Shen et al., 2006).

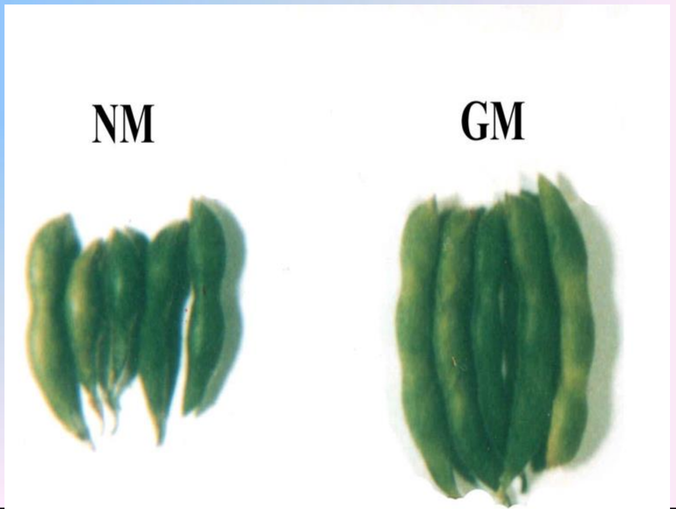
4- AM are well known for the enhancement of phosphorus uptake and this nutritional benefit has been speculated and counted to plant tolerant to heavy metals (Diaz et al., 1996; Shen et al., 2006).

5- Reduced the concentration of the soluble heavy metals in soil possibility by absorption of metals on the extraradical hyphae (Rashid et al., 2009).

6- Bradley et al. (1982) concluded that metals may bind to the interfacial matrix found between the hyphae of the mycorrhizae or accumulate in their vacuolar bodies (Turanu et al., 1994). This binding would then either reduce further movement of the metals through the mycorrhizae to the host tissues, or removed metabolically by the fungus and sequestered in harmless form within its hyphae

Mycorrhizal fungi as biofertilizers

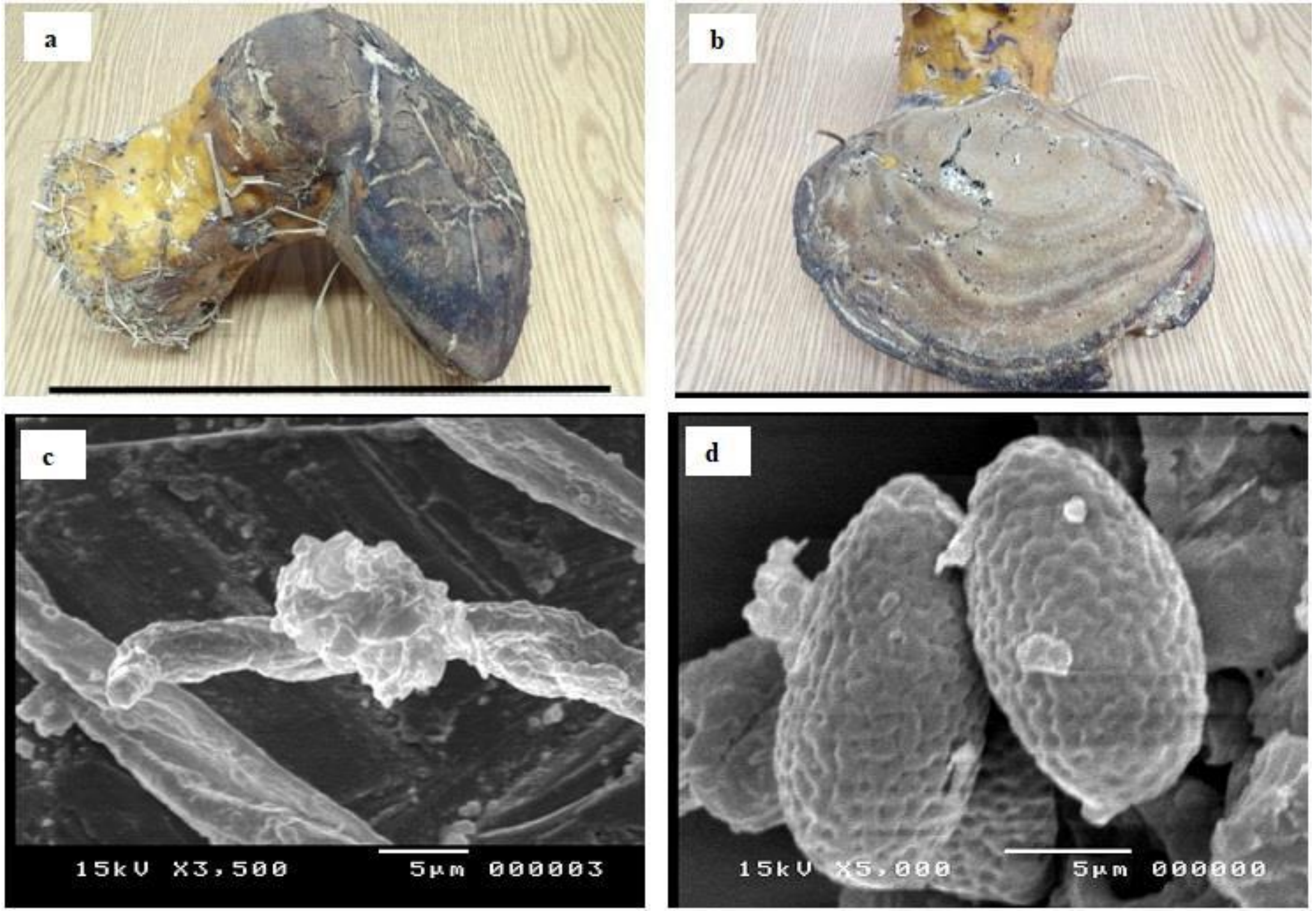




New records on the genus *Tomophagus and Battarrea* for mycobiota of Egypt

Abdel-Azeem AM1* and Nafady NA2

- During an extensive survey of macrobasidiomycota and the effects of climate changes on their distribution supported by Alexandria Research Center for Adaptation (ARCA) in Egypt and Mohamed bin Zayed Species Conservation Fund (MBZ), several specimens collected, examined and preserved. As a result, two species of *Tomophagus colossus* (Fr.) Murrill (Basidiomycota, Ganodermataceae) and *Battarrea phalloides* (Dicks.) Pers. (Basidiomycota, Agaricaceae) were identified and recorded as new records. Both taxa were identified phenotypically and were subjected to sequencing for confirmation.



a–d *Tomophagus colossus* ((Fr.) Murrill, Torreya 1905). a Basidiomata (lateral view, Scale bar: 20 cm). b Hymenial surface of basidiomata showing angular to rounded pores (lower view, Scale bar: 20 cm. c Skeletal hyphae by SEM. d Mature basidiospores by SEM.

a–e *Battarrea phalloides* ((Dicks.) Pers. 1801). a Basidiomata in the field. b Basidiomata (lateral view, Scale bar: 30 cm). c Basidiomata (top view, Scale bar: 5cm). d Elaters by SEM. e Mature basidiospores by SEM.

AGARICALES FROM THE COUNTRYSIDE AND GRASSLANDS OF EAST DELTA REGION, EGYPT

Fungi have vital roles in ecosystem health. There are numerous fungi that produce fleshy fruiting bodies known as mushrooms, many of which are prized for their edible and medicinal uses. Most of the gourmet mushrooms are saprophytic wood decomposing fungi which are considered as the premier recyclers on the planet. White and brown rots basidiomycetes are the most widely used in bioremediation of toxic wastes especially heavy metals. Current and perspective future uses include the detoxification of polychloralbiphenols, pentachlorophenol, oil, pesticide and herbicide residues (Bressa, 1988 and Stijve, 1992).

The aim of this investigation is to survey and identify some of the Egyptian wild mushrooms hopefully for use in medical purposes, culture uses, antibacterial, soil fertilizers and to nullify the effects of pesticides.

Table 1: Distribution of the collected wild mushrooms in East Delta Region, Egypt

Fungal species	Date of collection	Season of collection				Location & substrate	Number of mushrooms/ each season
		Autumn	Winter	Spring	Summer		
Volvariella Speciosa	1999 2000	+ +	+ +	- -	- -	Damietta & New –Damietta count.s Soil	Eight / ten Two/ ten
Psathyrella piluliformis	2001 2002	+ +	+ +	- -	- -	Damietta count.s Dead wood	Fifteen /twenty Ten/twelve
Panaeolus sphinctrinus	1999 2000 2001 2002	+ + + +	+ + + +	- - - -	- - - -	Damietta count.s soil	Four/two Three/ten Eight/two Twenty/ten
Deconica coprophila	1999	-	+	-	-	Mansoura count.s Dung	Eight
Agrocybe cylindracea	1999 2000 2001 2002	+ + + +	+ + + +	- - - -	- - - -	Mansoura countryside Deciduous trees	Hundreds
Pholiotina subnuda	1999	-	+	-	-	Mansoura count.s Soil	Eleven
Conocybe subovalis	1999	-	+	-	-	New Damietta count.s Grassland	Five
Lyophyllum buxeum	1999	+	-	-	-	Damietta city garden Soil	Seventeen
Strobilurus tenacellus	2000	+	-	-	-	Mansoura count.s Soil	Six
Agaricus vaporarius	1999 2000	-	+ +	-	-	Mansoura count.s Buried in soil	Six Seven
Agaricus lanipes	1999 2000	+	+	-	-	Damietta count.s Soil	Six/five Five/five
Agaricus campester	2002	-	+	+	-	Damietta count.s Soil	Five/two
Agaricus cupreo-brunneus	2001	-	+	-	-	Damietta count.s Soil	Two
Agaricus brunneolus	2000	+	-	-	-	Mansoura count.s soil	Four

Most of the present fungal species started to grow with the beginning of autumn and continued to grow in winter. Few other species could grow only in winter so they prefer lower temperatures; these are *Agaricus cupreobrunneus, A. vaporarius, Conocybe subovalis* and *Pholiotina subnuda* (table 1). *Agaricus campester* is the only one species which can grow and survive in winter and spring.

The growth of wild mushrooms in autumn and winter could be referred to the suitable climatic conditions of North East Delta during these seasons, where temperature was around $20C^0$, Humidity at these areas could reach 40% and cold weather prevailed.

Plate (1): ***Volvariella speciosa***

Plate (2): ***Psathyrella piluliformis***

Plate (3): ***Panaeolus sphinctrinus***

Plate (4): ***Deconica coprophila***

Plate (5): ***Agrocybe cylindracea***

Plate (6): ***Pholiotina subnuda***

Plate (7): ***Conocybe subovalis***

Plate (8): ***Lyophyllum buxeum***

Plate (9): ***Strobilurus tenacellus***

Plate (10):*Agaricus vaporarius*

Plate (11) :*Agaricus lanipes*

Plate (12): *Agaricus campester*

Plate (13): *Agaricus cupreo-brunneus*

Plate (14): *Agaricus* brunneolus

In many parts of developing countries, agricultural solid wastes are indiscriminately dumped or burnt in public places, thereby resulting in the generation of air pollution, soil contamination, harmful gas, smoke, and dust and the residue may be channeled into a water source thereby polluting the water and aquatic environment.

Burning rice straw...

Rice straw burning could result in biomass burning which is the second-largest source of trace gases and the largest source of primary fine carbonaceous particles in the global troposphere.

Open-burning of rice straw in the field is of incomplete combustion in nature; hence, a large number of pollutants are emitted such as SO2, NOx, including toxic gases such as carbon monoxide (CO), dioxins and furans, volatile organic compounds (VOC), carcinogenic polycyclic aromatic hydrocarbons (PAH), as well as fine inhalable particles.

Cont'd...

The intensive burning of agricultural wastes may substantially contribute to the formation of Atmospheric Brown Cloud (ABC) that affects local air quality, atmospheric visibility, and Earth's climate.
Open-burning of straw residues also contributes to global warming through emissions of greenhouse gases (GHGs) such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

Climate change is the fundamental design problem of our time: buildings are hugely complicit in the crisis.

Together, buildings and construction contribute 39% of the world's carbon footprint.
Energy used to heat, cool, and light buildings account for 28% of these emissions: households are the biggest emitter of greenhouse gases since 2015.

Cont'd…

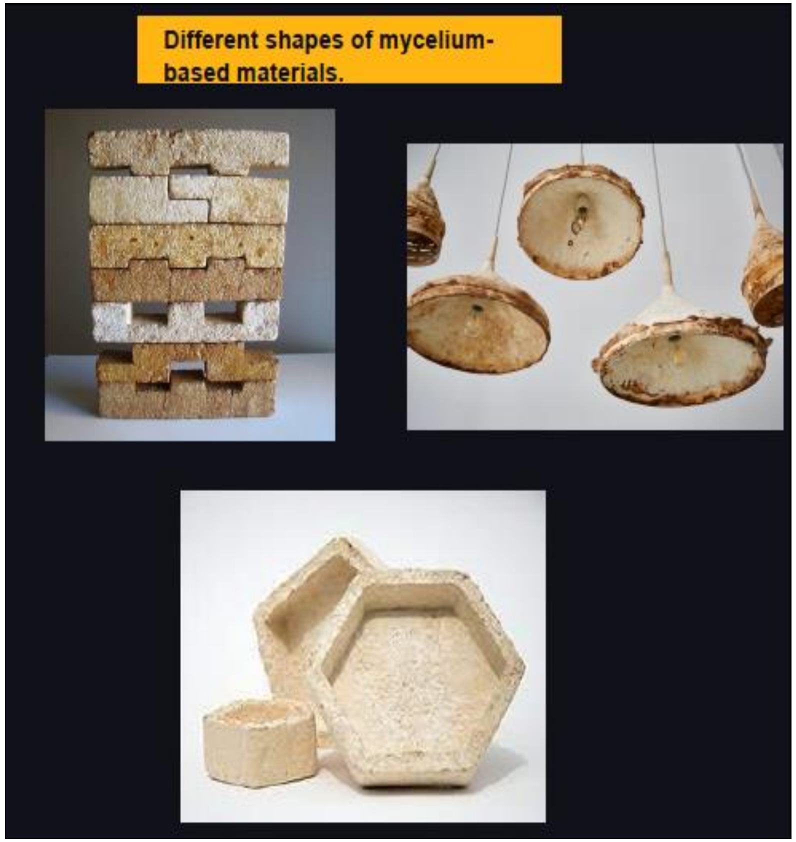
- The remaining 11% of buildings' carbon emissions consist of those associated with construction and building materials.
- Cement alone is responsible for a whopping 8% of global CO_2 emissions.
- Compare this to the much-maligned global aviation industry, which emits 2% of all human-induced CO_2 emissions.
- Buildings and, by association, the construction industry, are profoundly responsible for climate change.
- There is evidently a real need for the construction industry to reduce the impact of its material and energy use and to take part in the transition toward a more sustainable economy by researching and using alternative materials.

Are there alternative building materials?

- -This is not an absurd ask: such materials already exist!

- **-Mycelium composites:**
- **Mycelium offers an exciting change to upcycle agricultural waste into a low-cost, sustainable, biodegradable construction material.**

- **Even NASA wants to use mycelium on Mars.**



Fungal Biodegradation and Enzymatic Activities on Sawdust.

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ABSTRACT

Lignin, cellulose and hemicellulose are components of the hard fibrous material as wood. Sawdust is a lignocellulosic waste form which pretreated before its use in compost pile and in bio-fuel production like ethanol. The most proper treatment of sawdust that implicates no side effects is utilizing microorganism. This work test the potentials of *Sclerotinia sclerotiorum*, *Rhizoctonia solani*, *Fusarium* species, *Ganoderma* species, *Trichoderma* species to biodegrade softwood (*Fagussil vaticus*) providing the media and optimal conditions for testing fungal growth. These circumstances are temperature, pH, moisture and the carbon source applied is only the sawdust. The capability of fungi to biodegrade wood will be determined and proved through the testing soluble proteins and reducing sugars through the incubation time. *Sclerotinia sclerotiorum* had the major significant cellulase activity after 27th day incubation (1.09 U/ml) then *Ganoderma* sp. (0.69 U/ml). The protein content obtained by *Sclerotinia sclerotiorum* was 3.8 and *Ganoderma* sp. was 3.6 at the 27th day.The pectinase production was screened by using two states of fermentation the solid and submerged state. *Ganoderma* sp. using solid state give 0.95 IU/ml pectinase activity but in case of submerged was 0.53 IU/ml. *Ganoderma* sp. produced higher pectinase at 35°C and pH 5.5.

Keywords: solid state fermentation, submerged fermentation, *Sclerotinia sclerotiorum*, *Ganoderma* sp., sawdust.

Analysis of wood decay and ligninolysis in Polyporales from the Nile Delta region of Egypt

El-Gharabawy HM 1,2, Detheridge AP2, El-Fallal AA1, El-Sayed AKA1, and Griffith GW2*

- Wood decay fungi found on living or dead trees in fruit orchards in the Nile Delta region of Egypt were isolated into pure culture and their ligninolytic capabilities examined. Growth on ash sawdust was monitored by quantification of ergosterol and laccase/peroxidase activities using the model substrate ABTS. Two species from the polyporoid clade of order Polyporales exhibited faster growth and greater enzymatic activity than two isolates from the phlebioid clade but these differences were not reflected in dry weight loss of wood. Cellophane strips impregnated Remazol Brilliant Blue dye and MnCl2 impregnated plates were used to show the distinctive spatiotemporal patterns for the four species.

Table List of origin and identity of the four isolates (RGR indicates radial growth rate on 2% MA; Clade* indicates to which of the Larsson *et al.* (2004) clades each isolate belongs).

Species	Family (Clade*)	Isolate code	GenBank Accession	RGR (mm/d)	Host tree	Collection Date	Area (Lat/Long)
Oxyporus (="*Emmia*") *latemarginatus*	Irpicaceae "phlebioid"	EM26	KX428467	13.0	*Mangifera indica* (Cut stump)	18-Dec-13	Damietta; El-Senaniah (N 31.2611, E 31.4648)
Ganoderma resinaceum	Ganodermataceae "polyporoid"	GR33	KX428468	8.7	*Casuarina equisetifolia* (Live)	1-Jan-14	Dakahlia; Mansoura Univ. (N 31.0403, E 31.3590)
Megasporoporia minor	Polyporaceae "polyporoid"	MG65	KX428469	10.4	*Salix alba* (Live)	4-Mar-14	Dakahlia; Dekernis (N 31.0637, E 31.6577)
Phanerochaetaceae sp.	"Byssomerulius" clade "phlebioid"	UN63	KX428470	1.6	*Phoenix dactylifera* (Dead)	26-Feb-14	Kafr El-Shaikh; Baltim (N 31.5764, E 31.0796)

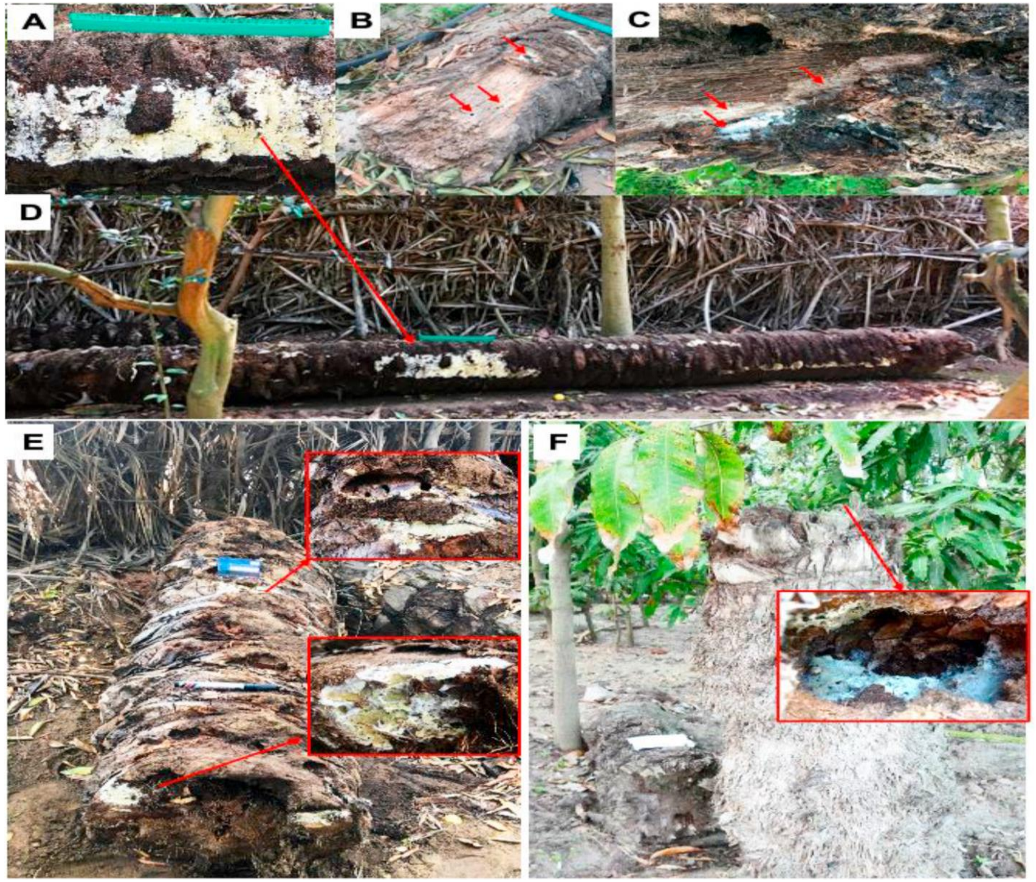
Xylanase, cellulase and peroxidase enzymes production by fungi in rice straw medium under submerged fermentation

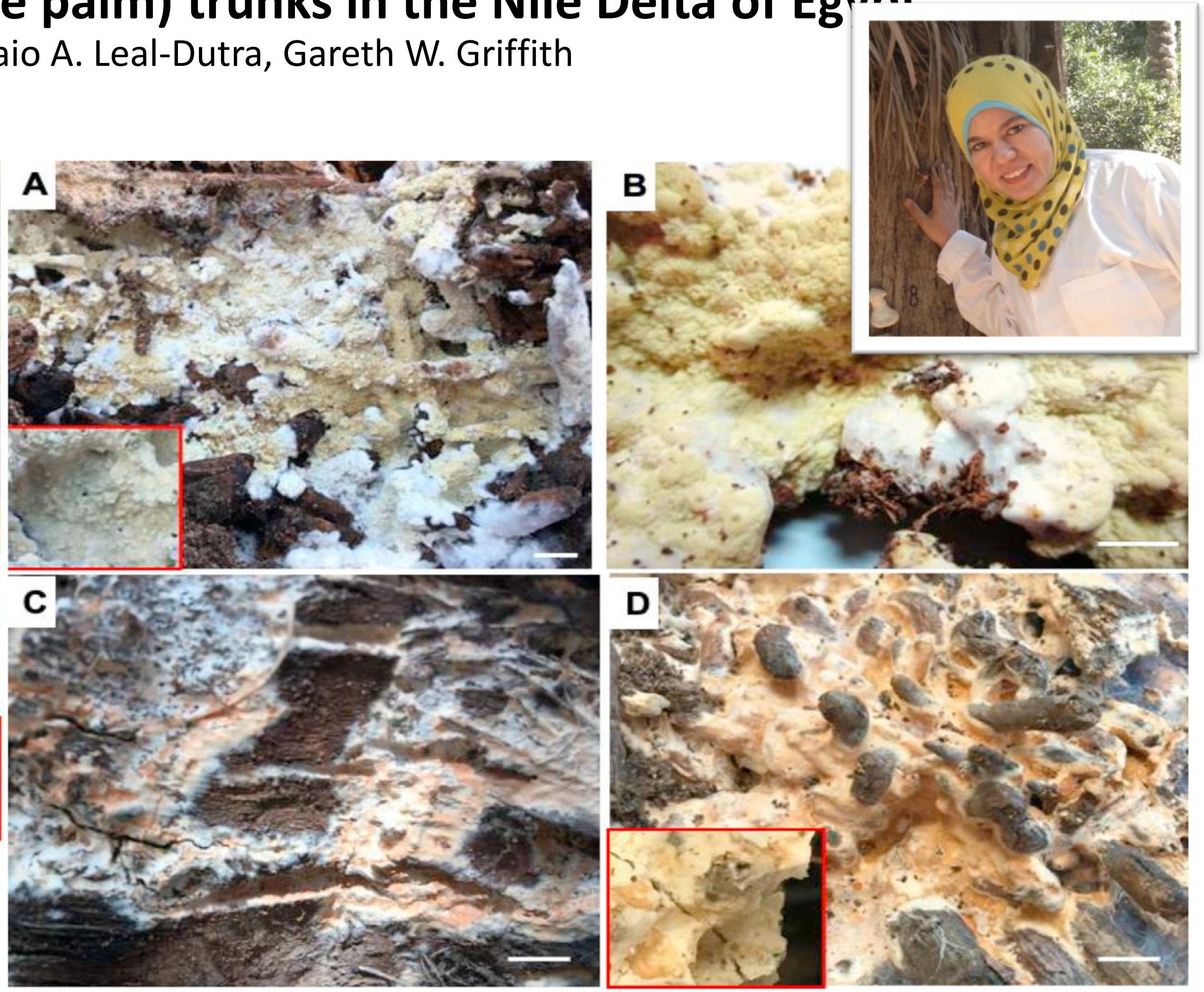
El-Sayed M. El.morsy , Sadat M. Khattab, Mai A. Ziad, Marwa T Mohesien

- Zygomycota comprises 3 genera and Ascomycota represented only by a single. These fungi were screened for their abilities to produce xylanase, cellulase and peroxidase enzymes on rice straw medium. Among these, *Aspergillus carneus* was selected for optimization of enzymes production, for many reasons, it was the highest xylanase producer in rice straw, and it has been reported that it does not produce mycotoxins.

Crystallicutis gen. nov. (Irpicaceae, Basidiomycota), including *C. damiettensis* sp. nov., found on *Phoenix dactylifera* (date palm) trunks in the Nile Delta of Egypt

Hoda M. El-Gharabawy, Caio A. Leal-Dutra, Gareth W. Griffith





Description ... ular tools

Hoda Mohamed E...

- *Morchel* ... from the *Morchel* ... autumn. It was rep... but not in Egypt. ... le on its ecology. ... cted from fruit far... 2016. The taxonom... phological and mo... based on morphol... clade. The morel h... wide and irregular...

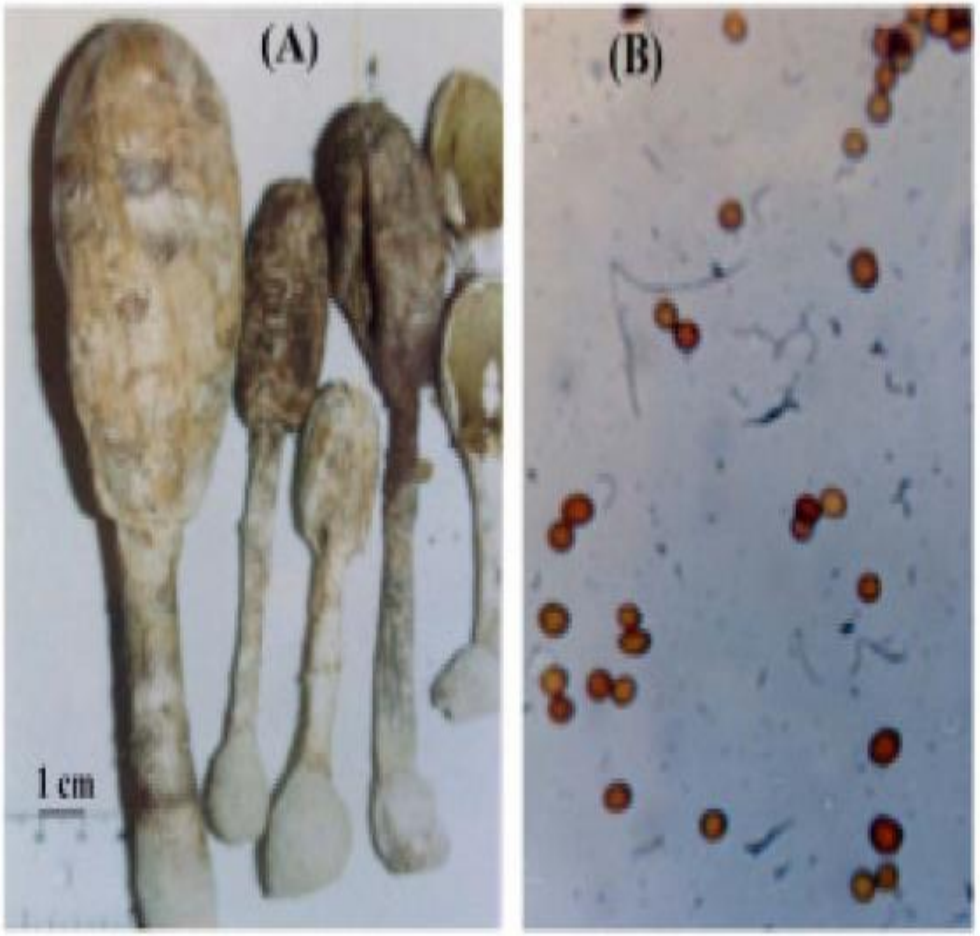
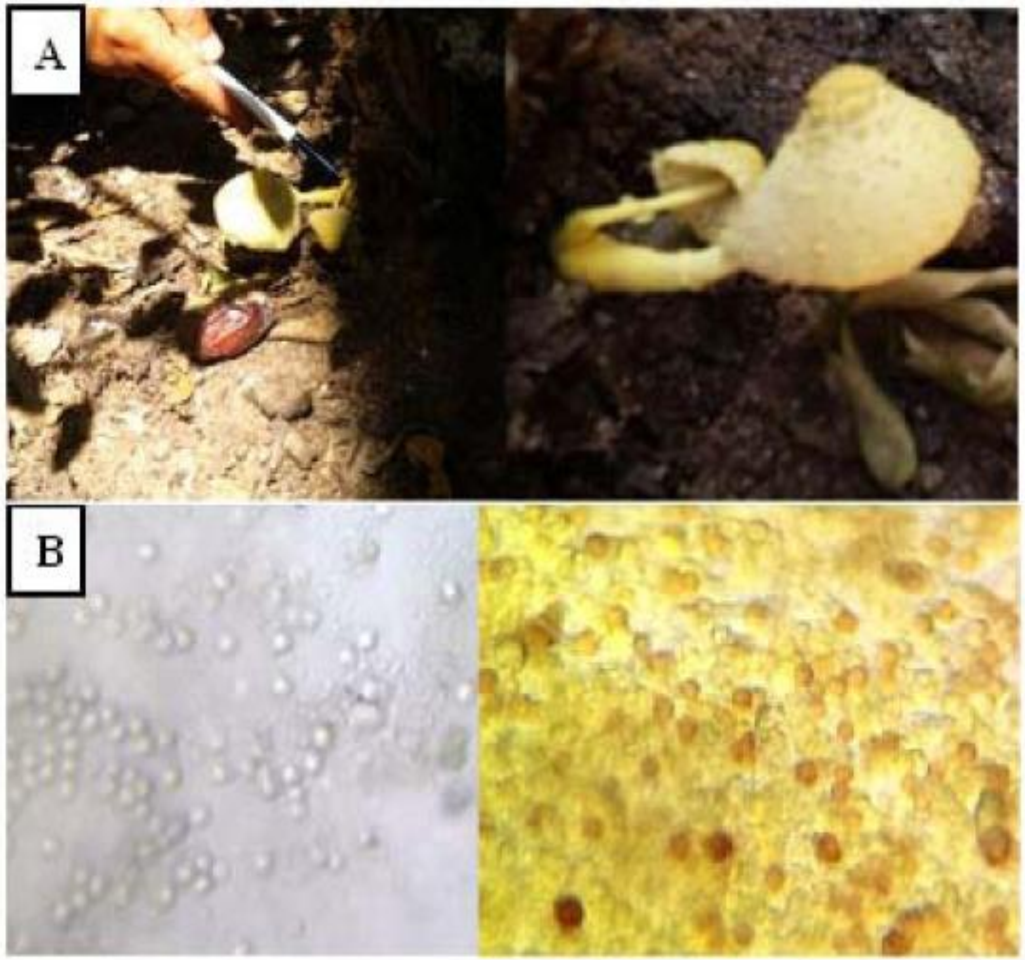


Fig. 1. Morphology of Egyptian *Podaxis pistillaris* fruiting bodies; (A) Dry gasterocarp with elongate cap and rigi woody stem, (B) Light microscopy field showing reddish brown subglobose basidiospores.



g. 2. Morphology of Egyptian *Leucocoprinus birnbaumii* fruiting bodies; (A) Canary-yellow colored agaric-mushroom with a bell-shaped cap and concolorous stipe growing on dead lemon tree trunk, (B) Light microscopy field showing colorless ellipsoid basidiospores on left and brown colored with Melzer reagent on right.

Table 3 Taxonomic assignment of the isolated taxa according to Kirk et al. (2008)

Phylum	Class	Order	Family	Genus	Species
Zygomycota	Incertae sedis	Mucorales	Cunninghamellaceae	1	1
			Mucoraceae	1	1
Ascomycota	Dothideomycetes	Pleosporales	Pleosporaceae	2	2
		Capnodiales	Cladosporiaceae	1	1
	Eurotiomycetes	Eurotiales	Trichocomaceae	6	18
		Onygenales	Gymnoascaceae	1	1
	Sordariomycetes	Hypocreales	Hypocreaceae	1	2
			Nectriaceae	1	1
			Incertae sedis	1	1
		Trichosphaeriales	Incertae sedis	1	1
Basidiomycota	Microbotryomycetes	Sporidiobolales	Incertae sedis	1	1
Total	4	8	8	17	30

on the results of mycobiota isolated from the different sites throughout the study, site no. 1 showed the highest Simpson's species diversity index of 0.859 while site no. 3 showed the lowest value

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Mucor racemosus as a biosorbent of metal ions from polluted water in Northern Delta of Egypt

El-Morsy EM, Nour El-Dein MM and El-Didamoney SMM

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El-Morsy EM, Nour El-Dein MM, El-Didamoney SMM 2013 – *Mucor racemosus* as a biosorbent of metal ions from polluted water in Northern Delta of Egypt. Mycosphere 4(6), 1118–1131, Doi 10.5943/mycosphere/4/6/9

Abstract

Twenty samples of polluted water were collected from Damietta's canals and drainages located near the industrial area of New Damietta. Initial concentrations of heavy metals including (zinc, copper and lead) in the polluted water were determined. Fourty–five fungal species were isolated. *Mucor racemosus, Aspergillus flavus, A. niger, A. fumigatus, Trichoderma koningi* and *Rhizopus oryzae* were isolated frequently. On the basis of its frequency, *Mucor racemosus* was chosen for biosorption studies.

Free and immobilized biomass of *Mucor racemosus* sequestered ions in this decreasing sequence Cu > Zn > Pb. The effects of biomass concentration, pH and time of contact were investigated. The level of ion uptake rose with increasing biomass till 200 mg and then decreased with increasing biomass. The maximum uptake for Cu (60.13 mg/g), Zn (57.67 mg/g) and Pb (21.97 mg/g) respectively occurred at 200 mg/l biomass. The uptake rose with increasing pH up to 5 in the case of Zn and Cu and 4 in the case of Pb. Maximum uptake for all metals was achieved after 15 minutes. Ion uptake followed the Langmuir adsorption model, permitting the calculation of maximum uptake and affinity coefficients. Treatment of *Mucor racemosus* biomass with 0.1 M NaOH at 120°C for 6 h improved biosorbent capacity, as did immobilization with alginate. Immobilized biomass could be regenerated readily with treatment with dilute HCl. The biomass-alginate complex efficiently removed Zn, Cu and Pb from polluted water samples. Therefore, *Mucor racemosus* could be employed either in free or immobilized form as a biosorbent of metal ions in waste water.

Effect of Biologically Treated Wheat Straw with White-Rot Fungi on Performance, Digestibility and Oxidative Status of Rabbits

- *Pleurotus sajor-caju* , *P. columbinus* and *P. floridanus* are good sources of protein content when grown on wheat straw as a substrate which agreed with many types of research. These spp. are good producers of enzymes (cellulases, xylanases, Mn-peroxidase and laccase)37 making wheat straw easy to be digested by other types of animals, not only ruminants38-41.

- Thus, the final product, in addition to the good content of carbohydrates, protein and other components of the mushroom, is more digestible and is free from any chemical additives that may lead to animal health problems affecting the livestock and human health. Many researchers have used several kinds of mushrooms for the same purpose.

Efficiency of microbial consortium in bioremediation of diesel oil

El-Sayed M El-Morsy Mohamed Ismail Abou-Dobara Marwa twakol Mohesien

- Bacillus sp. H6 and Aspergillus flavus were investigated in a laboratory scale for the efficiency for the bioremediation of a diesel-oil contaminated soil. Seven microcosms were set up namely; Bacillus sp. H6, Aspergillus flavus, Bacillus sp. H6 + Aspergillus flavus consortium, natural non-treated control, cycloheximide treated, benzyl Penicillin.

Mycoremediation of Plastic Wastes is Our Challenge for the Next Decade

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Fungi are known to degrade, or deteriorate, a wide variety of materials and compounds. These processes are known as mycodegradation and mycodeterioration. Plastic is one of the most common synthetic polymers used in various applications such as coatings, fibers, paints, and packaging. Although, plastic has many advantages (such as it being lightweight, low cost, and highly durable), it causes various threats to the environment due to its non-degradable nature and lack of safe disposal sites (landfills) in Egypt. Therefore, new techniques for the remediation of plastic wastes should be used based on degradation. This study aims to investigate the capabilities of local fungal isolates on plastic degradation in vitro. Fourteen genera and twenty species were recovered from twenty-five soil samples were collected from different plastic waste disposal sites in Egypt. The plastic degradable fungi were isolated and identified by morphological and molecular biology means. Out of the fourteen genera recovered, genus Aspergillus was the most frequent. A. versicolor, A. sydowii, A. terreus, A. ochraceus, A. candidus, A. niger, and A. flavus were screened for the production of extracellular enzymes as one of the most important mechanism for plastic degradation. Modeling experiment has been designed for biodegradation of synthetic plastic sheet by the isolated taxa. Plastic degradation was estimated by different techniques such as weight loss, Scanning Electron Microscopy (SEM), and Fourier Transform Infrared spectroscopy (FTIR) spectroscopy. Different trails to immobilize potential fungal taxa and the effects of pH and co-substrates were investigated at different contact times.

Keywords: *Aspergillus*, Egypt, Enzymes, Immobilization, Mycodegeradation, Plastic waste management.


A
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A
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Conventions List			
Name of Convention (Click for Detail)	**Date of Signature**	**Date of Ratification**	**Date of Entry into Force**
Climate Change			
UN Framework convention on Climate change (UNFCCC)	6/9/1992	12/5/1994	3/5/1995
Kyoto Protocol	3/15/1999	1/12/2005	4/12/2005
Vienna Convention on the protection of the ozone layer	3/22/1985	5/9/1988	
Montreal Protocol on substances that deplete the ozone layer	9/16/1987	8/2/1988	
Paris Agreement	4/22/2016		
Hazardous Substances and Wastes			
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal		1/8/1993	
Stockholm Convention on Persistent Organic Pollutants	5/17/2002	5/2/2003	
Convention On The Ban Of The Import Into Africa And The Control Of Transboundary Movement And Management Of Hazardous Wastes Within Africa (Bamako Convention)	1/30/1991	5/18/2004	
Marine Pollution			
Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment (Jeddah Convention)		5/31/1990	8/20/1985
Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean	2/16/1976	8/24/1978	7/9/2004
Nature Conservation			
United Nations Convention on Biological Diversity (UNCBD)	6/9/1992	6/2/1994	
Cartagena Protocol on Bio-safety to the Convention on Biological Diversity	12/20/2000	12/23/2003	3/21/2004
Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization	1/25/2012	10/28/2013	
Ramsar Convention on Conservation and Wise Use of Wetlands			9/9/1988
Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area (ACCOBAMS)		4/19/2010	7/1/2010
Convention on the Conservation of Migratory Species of Wild Animals (CMS), Bonn convention			11/1/1983
Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA)	8/20/1997	11/1/1999	11/1/1983

- **At present, Egypt needs more investigators and funds to explore and develop this research field and, therefore, the extensive collection of fungi in unexplored areas remains a priority.**

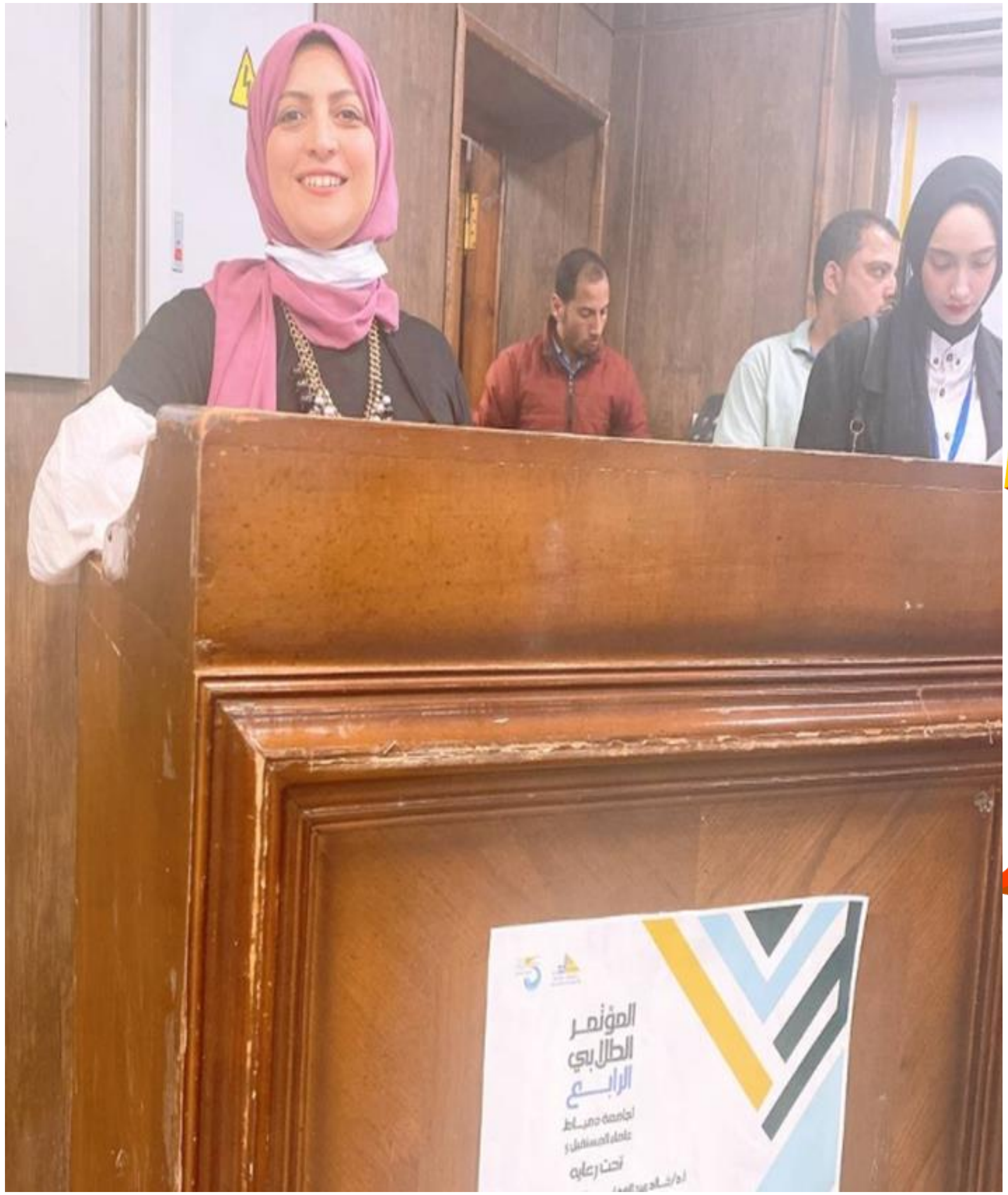
Fungal conservation:

- Although the wellbeing of fungi is essential for life on this planet, amazingly, up to now, they have been almost totally overlooked by all mainstream conservation movements. But the fungi have no special features which protect them from destructive human activity and climate change. Like animals and plants, they too are endangered by climate change, habitat destruction and pollution. They too need their champions to protect them.

- In Egypt only two centers are recorded: EMCC (WDCM583) Egypt Microbial Culture Collection,

- Cairo Microbiological Resources Centre (Cairo MIRCEN), Ain Shams University, and NODCAR WDCM822 Marwa Mokhtar Abd Rabo, National Organization of Drug Control and research.

- However, Moubasher and his colleagues founded the Assiut University Mycological Centre (AUMC) in 1999 where more than 6 000 fungal isolates belonging to more than 500 species are being preserved under low temperature (5 °C), deep-freezed (-80 °C), and lyophilized; this is the biggest reference culture collection in the Arab countries. The centre also has a collection of dried specimens (i.e. a fungarium) which is rare in Arab countries. In spite of this the AUMC is not yet registered with the WFCC.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تحت رعاية

Thank you