



MediPharm

International Journal of MediPharm Research

ISSN:2395-423X

www.medipharmsai.com

Vol.02, No.01, pp 23-31, 2016

Investigation of diversity of endophytic, phylloplane and phyllosphere mycobiota isolated from different cultivated plants in new reclaimed soil, Upper Egypt with potential biological applications

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Abstract : Isolation and identification of endophytic, phylloplane and phyllosphere fungal diversity from different plants cultivated in four reclaimed areas at Assiut Governorate in Egypt, namely: El-Ghorayeb (GH), El-Wady El-Assiuty (WA), Petroleum's Farm (PF) and protectorate of Assiut (PR) were conducted. PR showed the widest spectrum of fungal species resulting in isolation of 76 species and 6 varieties belonging to 34 genera followed by WA (71 species and 4 varieties belonging to 33 genera), PF (69 species and 3 varieties belonging to 30 genera) and GH (59 species and one variety belonging to 29 genera). Since endophytes are recognized as sources of novel metabolites, industrial enzymes and as agents that enhance the abiotic or biotic stress tolerance of their plant hosts, novel natural compounds can be isolated and identified from endophytes, phylloplane or phyllosphere fungi with a promising potential biological, medical and industrial applications.

Keywords: Fungi, endophytic fungi, isolation, identification, phylloplane fungi, phyllosphere fungi, reclaimed soil.

1. Introduction

The term phyllosphere fungi was coined by Last¹ to describe organisms found on the plant leaf surface. Phylloplane fungi are the inhabitants of leaf surfaces and promote their growth and sporulation by the virtue of varied nutrients available in the leaf² On the other hand, endophytes play a major role in physiological activities of host plants influencing (enhancing) disease resistance³. They constitute a valuable source of bioactive secondary metabolites of biotechnological importance in plant disease management programs⁴. Several works were made to describe the microorganisms on the leaf surface of several plants growing or cultivated in many parts of the world^{5,6,7}. El-Kady⁸ studied the occurrence of phyllosphere and phylloplane fungi on leaves surface of 15 different kinds of fresh herbs belonging to three plant families. Abdel-Hafez⁶ reported that 33 species and 2 species varieties belonging to 15 genera were isolated from the phyllosphere of wheat plant and the most

prevalent genera were *Alternaria*, *Aspergillus*, *Cladosporium*. Abdel-Hafez⁹ studied the leaf surface and endophytic fungi on onion leaves and isolated 68 fungal species belonging to 29 genera, *Aspergillus* and *Cladosporium* were the most prevalent genera in the phylloplane and *Aspergillus niger* was the most prevalent species. Phyllosphere and phylloplane non-pathogenic fungi associated with plant surfaces are often able to suppress growth and sporulation of plant pathogens¹⁰. The possibility of controlling pathogenic fungi by antagonistic microorganisms has been explored in many investigations^{11,12,13}. In this study, the mycobiota in leaves (phyllosphere and phylloplane) of different plants cultivated in four reclaimed areas at Assiut Governorate namely: El-Ghorayeb (GH), El-Wady El-Assiuty (WA), Petroleum's Farm (PF) and protectorate of Assiut (PR) were investigated.

2. Experimental / Materials and methods

2.1 Selected Areas

Four areas representing the largest and distinctive regions of newly reclaimed soil at Assiut Governorate in Egypt were selected. These were Protectorate of Assiut (PR) lies at 25 km southeast Assiut, El-Ghorayeb (GH) lies at 20 km southeast Assiut, El-Wady El-Assiuty (WA) lies at 10 km east Assiut and Petroleum's farm (PF) lies at 10 km northwest Assiut.

2.2 Fungi isolation

2.2.1 Phyllosphere fungi

Ten gram of plant's leaves segments were placed in sterile conical flasks containing 100 ml sterile distilled water. Flasks were shaken by hand in a rotating motion for 10 minutes., 10 ml of the suspension were transferred into another flask (250 ml) contains 90 ml sterile distilled water, then the flask was shaken for 5 minutes. Final dilutions were made in the same way to obtain a series of dilution. One ml of the final dilution was transferred to sterile Petri-dish and the agar medium was poured. Five replicates were prepared for each sample then were incubated at 28 °C ± 1 for 7 days.

2.2.2 Phylloplane fungi

Leaves from plants (Table 1) were subjected to a series of washing with sterile distilled water. They were thoroughly dried between sterile filter paper, cut into equal segments (about 1 cm each). One hundred segments were selected per each sample. Five segments were placed on the surface of the agar medium in each plate, then the plates were incubated at 28 °C ± 1 for 7-10 days.

2.3 Identification of fungal genera and species

Identification of the isolated fungi during our investigation was carried out using the morphological and microscopic features according to the following references:

- 1- Ames¹⁴, for *Chaetomium* species.
- 2- Booth^{15,16}, for *Fusarium* species.
- 3- Domsch¹⁷, for fungi in general.
- 4- Moubasher¹⁸: For fungi in general.

Also, identification of the isolated fungi was reviewed and compared with the same species deposited in Assiut University Mycological Center (AUMC).

2.4 Phyllosphere and phylloplane samples

Leaves of plants in Table 1 were also collected from the above investigated localities, packed directly into polyethylene bags and kept in refrigerator until use.

3. Results and discussion

Few investigations have been carried out on the mycobiota of the newly reclaimed areas especially at Assiut Governorate, Egypt. The isolation and identification of mycobiota from such areas give us a good idea about the probability of existence of pathogenic species, which may attack cultivated plants in these areas and become injurious to the plants. From the isolated phyllosphere fungi as shown in Table 2, it was found that PR showed the widest spectrum of fungal species resulting in isolation of 76 species and 6 varieties belonging to 34 genera followed by WA (71 species and 4 varieties belonging to 33 genera), PF (69 species and 3 varieties belonging to 30 genera) and GH (59 species and one variety belonging to 29 genera). This is nearly similar to those recorded by several authors^{19,20}. El-Kady⁸ isolated 59 species + 2 species varieties belonging to 31 genera and 44 + 3 belonging to 20 genera and 44 species belonging to 25 genera of phyllosphere from five different herbs of each of *Solanaceae*; *Labiatae* and *Umbelliferae*, respectively, on two types of media at 28 °C ± 2. El-said²⁰ identified 66 species + 4 varieties belonging to 35 genera of phyllospheric fungi from banana Leaves. *Aspergillus* was the most common genus, regularly appeared during all months in the four localities. *A. japonicus*, *A. flavus* and *A. terreus* were isolated in high frequencies in all localities while, *A. versicolor* and *A. ochraceus* were recorded with high occurrence in only two and one localities, respectively. On the other hand, *A. sydowii* and *A. fumigatus* were isolated with high or moderate frequencies from the all localities. In addition, *A. aegyptiacus* was recorded with high and moderate occurrence in PR and GH, respectively. These results were confirmed by many authors and found that *Aspergillus* was the most common phyllosphere fungus found on the leaf surface of different plants in Egypt^{12,22}. *Alternaria*, *Penicillium*, *Chaetomium* and *Stachybotrys* were the most common genera of phyllosphere fungi and isolated with high occurrence from the four localities. On the other hand, *Cochliobolus* and *Emericella* were recorded with high frequencies in only three localities. *Fusarium* was estimated with high occurrence in only two localities while, *Acremonium*, *Setosphaeria*, and *Ulocladium* were isolated with high occurrence from one locality. Of these genera, the most frequently encountered species were: *Alternaria alternata*, *Penicillium chrysogenum*, *P. corylophilum*, *P. funiculosum*, *P. brevicompactum*, *P. citrinum*, *Chaetomium globosum*, *Stachybotrys chartarum*, *Cochliobolus spicifer*, *Emericella nidulans*, *Fusarium oxysporum*, *Acremonium strictum*, *Setosphaeria rostrata* and *Ulocladium chartarum*. Most of the above genera and species were recorded as common phyllosphere fungi of different plants in other works^{6,23}.

Table (1): List of common plants cultivated in the four selected areas (PR, GH, WA and PF)

Protectorate of Assiut (PR)		El-Ghorayeb (GH)		El-Wady El-Assiuty (WA)		Petroleum's farm (PF)	
Latin name	Common name	Latin name	Common name	Latin name	Common name	Latin name	Common name
<i>Ocimum basillicum</i> L.	Basil	<i>Arachis hypogaea</i> L.	Earth nut	<i>Lycopersicum esculentum</i> Mill.	Tomato	<i>Helianthus annuus</i> L.	Sun-flower
<i>Zea mays</i> L.	Maize	<i>Vitis vinifera</i> L.	Grape vine	<i>Cucumis melo</i> L. var. <i>cantalupensis</i> Naud.	Cantaloupe	<i>Triticum sativum</i> L.	Wheat
<i>Helianthus annuus</i> L.	Sun-flower	<i>Solanum tuberosum</i> L.	Common potato	<i>Psidium guajava</i> L.	Guava	<i>Lycopersicum esculentum</i> Mill.	Tomato
<i>Hordeum vulgare</i> L.	Barley	<i>Trifolium alexandrinum</i> L.	Egyptian clover	<i>Punica granatum</i> L.	Pomegranate	<i>Vitis vinifera</i> L.	Grape vine
<i>Artemisia herba-alba</i> Del.	Wormwood	<i>Vicia faba</i> L.	Broad bean	<i>Citrullus vulgaris</i> Schrad.	Water-melon	<i>Zea mays</i> L.	Maize
<i>Vicia faba</i> L.	Broad bean	<i>Psidium guajava</i> L.	Guava	<i>Vitis vinifera</i> L.	Grape vine	<i>Solanum melangena</i> L.	Egg plant Mandarin
<i>Datura stramonium</i> L.	Thorn-apple	<i>Musa paradisiaca</i> L.	Banana	<i>Helianthus annuus</i> L.	Sun-flower	<i>Citrus ourantium</i> var. <i>deliciosa</i> L.	sorange
<i>Rosmarinus officinalis</i> L.	Rosemary			<i>Triticum sativum</i> L.	Wheat	<i>Morus alba</i> L.	Molberry
<i>Trifolium alexandrinum</i> L.	Egyptian clover			<i>Rosmarinus officinalis</i> L.	Rosemary	<i>Psidium guajava</i> L.	Guava
<i>Trigonella foenum-graecum</i> L.	Fenugreek					<i>Mangifera indica</i> L.	Mango
<i>Zygophyllum coccineum</i> L.	Syrian bean caper					<i>Hordeum vulgare</i> L.	Barley

Table (2): Occurrence remark of fungi isolated from the different selected areas.

Genera & Species	El-Ghoraiyeb		El-Wady El-Assiuty		Petroleum's farm		Protectorate of Assiut	
	P.S	P.P	P.S	P.P	P.S	P.P	P.S	P.P
<i>Acremonium roseolum</i>	R	-	-	-	R	-	-	-
<i>A. strictum</i>	M	R	H	R	M	L	M	L
<i>Alternaria alternata</i>	H	H	H	H	H	H	H	H
<i>A. chlamydospora</i>	-	-	R	R	R	-	-	-
<i>Arthrinium sacchari</i>	-	-	-	R	-	-	-	-
<i>Aspergillus aegyptiacus</i>	M	-	R	-	R	-	H	-
<i>A. carbonarius</i>	L	-	-	L	-	-	-	R
<i>A. carneus</i>	-	-	-	-	-	-	R	-
<i>A. flavipes</i>	-	-	R	R	-	-	L	R
<i>A. flavus</i>	H	M	H	H	H	H	H	H
<i>A. flavus</i> var <i>columnaris</i>	-	-	R	R	R	-	R	R
<i>A. fumigatus</i>	M	-	M	M	M	-	M	R
<i>A. japonicus</i>	H	H	H	H	H	H	H	H
<i>A. melleus</i>	R	-	R	R	L	-	-	-
<i>A. ochraceus</i>	M	R	L	L	H	H	M	M
<i>A. sulphoreus</i>	-	-	-	-	R	-	-	-
<i>A. sydowii</i>	M	-	H	M	H	R	H	M
<i>A. tamari</i>	-	-	-	-	L	R	-	-

Table (2): Continued.

Genera & Species	El-Ghoraiyeb		El-Wady El-Assiuty		Petroleum's farm		Protectorate of Assiut	
	P.S	P.P	P.S	P.P	P.S	P.P	P.S	P.P
<i>A. terreus</i>	H	R	H	M	H	M	H	H
<i>A. ustus</i>	R	-	L	-	M	M	M	L
<i>A. versicolor</i>	L	M	H	L	H	H	H	H
<i>Botryotrichum piluliferum</i>	L	-	L	M	L	-	L	-
<i>Chaetomium globosum</i>	H	M	H	H	H	M	H	H
<i>C. spirale</i>	L	-	L	M	M	-	H	H
<i>Circinella muscae</i>	R	-	-	-	-	-	-	-
<i>Cladosporium cladosporioides</i>	M	M	M	H	M	H	M	M
<i>C. oxysporum</i>	M	L	R	R	L	M	R	L
<i>C. sphaerospermum</i>	L	-	M	R	M	-	L	-
<i>Cochliobolus australiensis</i>	-	-	-	-	R	R	-	-
<i>C. hawaiiensis</i>	M	R	R	R	M	R	M	R
<i>C. lunatus</i>	L	R	R	M	M	L	M	M
<i>C. sativus</i>	-	-	R	-	-	-	-	-
<i>C. spicifer</i>	H	M	H	M	H	H	H	H
<i>C. tuberculatus</i>	-	-	-	-	R	-	R	-
<i>Curvularia ovoidea</i>	R	R	R	-	-	-	R	-
<i>Cunninghamilla echinulata</i>	L	R	-	R	-	-	R	R
<i>C. elegans</i>	R	-	R	R	-	-	M	R
<i>Doratomyces microsporus</i>	M	R	L	L	L	L	R	L
<i>D. stemonitis</i>	-	-	-	-	R	-	-	-
<i>Emericella nidulans</i>	H	L	M	M	H	M	H	H

Table (2): Continued.

Genera & Species	El-Ghoraiyeb		El-Wady El-Assiuty		Petroleum's farm		Protectorate of Assiut	
	P.S	P.P	P.S	P.P	P.S	P.P	P.S	P.P
<i>E. nidulans</i> var. <i>acristata</i>	L	-	-	R	R	R	M	R
<i>E. nidulans</i> var. <i>dentata</i>	-	-	L	R	R	-	L	R
<i>E. nidulans</i> var. <i>lata</i>	-	-	-	-	-	-	R	-
<i>E. quadrilineata</i>	-	-	-	-	R	-	R	R
<i>E. rugulosa</i>	R	-	-	-	R	-	-	-
<i>E. violacea</i>	R	-	-	-	R	-	-	-
<i>Epicoccum nigrum</i>	L	L	M	-	M	M	M	M
<i>Eurotium amstelodami</i>	R	-	M	-	R	R	R	-
<i>E. repens</i>	-	R	-	-	-	-	-	-
<i>Fennellia nivea</i>	-	-	-	-	R	-	-	-
<i>Fusarilla indica</i>	-	-	-	-	-	-	R	-
<i>Fusarium avenaceum</i>	-	-	-	-	-	-	R	R
<i>F. chlamyosporum</i>	-	-	-	-	R	-	-	-
<i>F. culmorum</i>	R	-	-	-	L	L	L	R
<i>F. dimerum</i>	-	-	-	-	-	-	-	R
<i>F. equiseti</i>	-	-	-	-	-	-	L	R
<i>F. graminearum</i>	R	-	-	R	-	-	R	R
<i>F.lateritium</i>	-	-	L	R	-	R	R	-
<i>F. moniliforme</i>	-	-	R	-	-	-	-	-
<i>F. m. var. anthophilum</i>	-	-	R	-	-	-	-	-

Table (2): Continued.

Genera & Species	El-Ghoraiyeb		El-Wady El-Assiuty		Petroleum's farm		Protectorate of Assiut	
	P.S	P.P	P.S	P.P	P.S	P.P	P.S	P.P
<i>F. m. var. subglutinans</i>	-	-	L	-	-	-	L	R
<i>F. nivale</i>	-	-	-	-	-	R	-	-
<i>F. oxysporum</i>	M	L	M	M	H	M	M	M
<i>F. sambucinum</i>	-	-	L	R	-	-	-	R
<i>F. semitectum</i>	-	-	-	-	-	-	L	-
<i>F. solani</i>	-	-	-	R	L	R	M	-
<i>Graphium putredinis</i>	-	-	R	R	-	-	-	-
<i>Humicola fuscoatra</i>	-	R	-	-	-	-	R	L
<i>H. grisea</i>	R	-	R	-	-	-	-	-
<i>Hypomyces chrysospermus</i>	-	-	R	-	L	-	-	-
<i>Macrophomina phaseolina</i>	L	-	-	R	M	-	R	L
<i>Mucor fuscus</i>	R	-	L	-	R	-	R	-
<i>M. circinelloids</i>	R	-	R	R	L	R	-	-
<i>M. racemosus</i>	-	-	-	-	R	-	-	-
<i>Myrothecium roridum</i>	R	-	L	-	-	-	L	M
<i>M. verrucaria</i>	R	L	-	R	M	L	M	M
<i>Neurospora crassa</i>	-	-	R	R	R	-	M	-
<i>Nigrospora sphaerica</i>	R	L	L	M	M	M	M	M
<i>Paecilomyces lilacinus</i>	-	-	R	-	-	-	-	-
<i>Papulaspora immersa</i>	-	-	-	-	L	-	R	-
<i>Penicillium brevicompactum</i>	R	R	M	R	L	-	M	M
<i>P. chrysogenum</i>	M	-	H	M	H	M	H	M
<i>P. camemberti</i>	-	-	R	-	-	-	-	-
<i>P. capsulatum</i>	-	-	-	-	R	-	-	-

Table (2): Continued.

Genera & Species	El-Ghoraiyeb		El-Wady El-Assiuty		Petroleum's farm		Protectorate of Assiut	
	P.S	P.P	P.S	P.P	P.S	P.P	P.S	P.P
<i>P. citrinum</i>	L	-	M	-	M	-	M	L
<i>P. corylophilum</i>	M	-	H	M	H	M	H	M
<i>P. expansum</i>	-	-	-	-	R	-	-	-
<i>P. frequentans</i>	-	-	-	-	-	-	R	-
<i>P. funiculosum</i>	R	-	H	-	M	R	M	R
<i>P. implicatum</i>	-	-	R	-	-	-	-	R
<i>P. oxalicum</i>	-	-	R	-	-	-	-	-
<i>P. purpurogenum</i>	L	-	L	R	M	L	M	-
<i>P. roquefortii</i>	M	-	L	R	-	-	-	R
<i>P. waksmani</i>	-	-	R	R	-	R	R	-
<i>Pestalotia</i> sp.	R	-	-	R	-	-	H	M
<i>Phoma glomerata</i>	-	-	-	-	-	-	R	R
<i>P. herbarum</i>	R	-	L	R	-	R	M	M
<i>Pithomyces atro-olivaceus</i>	-	-	L	-	-	-	-	-
<i>Rhizoctonia solani</i>	R	-	-	-	-	-	R	-
<i>R. stolonifer</i>	M	R	M	M	H	M	H	H
<i>Scopulariopsis brevicaulis</i>	-	-	M	-	L	-	R	-
<i>Setosphaeria rostrata</i>	M	L	M	R	H	M	M	M
<i>Stachybotrys chartarum</i>	M	R	H	-	H	R	H	M
<i>S. elegans</i>	R	-	R	-	-	-	R	-
<i>Stemphylium botryosum</i>	M	M	M	H	H	M	M	M
<i>S. vesicarium</i>	R	-	M	M	M	L	M	M

Table (2): Continued.

Genera & Species	El-Ghoraiyeb		El-Wady El-Assiuty		Petroleum's farm		Protectorate of Assiut	
	P.S	P.P	P.S	P.P	P.S	P.P	P.S	P.P
<i>Thermoascus aurantiacus</i>	-	-	-	-	L	-	R	-
<i>Trichoderma hamatum</i>	-	L	-	-	R	-	R	R
<i>T. harzianum</i>	-	-	R	R	-	-	R	-
<i>T. koningii</i>	-	-	-	-	-	-	R	-
<i>Trichothecium roseum</i>	-	-	R	-	R	-	L	-
<i>Trimmatostroma eriodictyonis</i>	-	-	-	-	-	-	-	R
<i>Ulocladium alternariae</i>	-	-	L	R	-	-	-	-
<i>U. atrum</i>	-	-	M	-	-	-	R	-
<i>U. botrytis</i>	M	-	M	M	L	1.3R	M	R
<i>U. chartarum</i>	R	R	H	R	L	2R	M	M
<i>U. chlamydosporum</i>	-	-	M	M	R	3.3L	M	L
<i>U. consortiale</i>	-	-	L	M	-	-	R	-

P.S = Phyllosphere P.P = Phylloplane

H = High occurrence. More than 5 cases out of 12 L = Low occurrence, 2 cases.

M = Moderate occurrence. Between 3-5 cases. R= Rare occurrence, one case

El-Naggar and Abdel-Hafez²² reported that *Alternaria alternata*, *Aspergillus flavus*, *A. niger*, *Cladosporium herbarum*, *Fusarium oxysporum*, and *F. solani* were common fungi isolated from the leaf surface of some wild plants in Sinai, Egypt. *Stemphylium botryosum* was recorded with high occurrence only in WA and with moderate frequency on the other three localities, while *Rhizopus stolonifer* was isolated with high occurrence in PR and with moderate frequency in WA and PF. On the other hand, *Epicoccum nigrum* recorded with moderate occurrence on only two localities while, *Eurotium amstelodami* and *Scopulariopsis brevicaulis* were isolated with moderate frequencies from only one locality. El-Kady⁸ detected the phyllosphere fungi of some herbal plants belonging to *Labiatae*, *Solanaceae*, and *Umbelliferae* in Egypt and found that *Emericella nidulans* and *Epicoccum nigrum* belonging to the fungal species isolated with high or moderate frequencies

from the different three families. The remaining genera and species during this study were isolated with low or rare frequencies from one or more of the four localities. Also, the above species were isolated but, with different incidences, from the leaf surfaces of several plants growing or cultivated in Egypt and in many parts of the world. Xiaoming²⁴ isolated eight species as a phyllosphere mold of *Populus tomentosa* Carr. in China namely: *Alternaria alternata*, *C. cladosporioides*, *C. sphaerospermum*, *C. oxysporum*, *Coniothyrium fuckelli*, *Hemicolpus fuscoatra*, *Acremonium strictum* and *Aureobasidium pullulans*. Concerning phylloplane fungi, the number of genera and species of phylloplane fungi isolated from the four localities tested were lower than those of phyllosphere fungi. The largest numbers of phylloplane fungal genera and species were recorded in WA (26 genera and 56 species + 3 varieties) followed by PR (25 and 55 + 4) while, the lowest numbers were estimated in GH (23 genera and 30 species) followed by PF (21 and 43 + 1). Abdel-Hafez²⁵ isolated 63 species and one variety belonging to 21 genera of fungi as phylloplane from *Triticum vulgare*. El-Kady⁸ found that the number of genera and species of phylloplane fungi isolated from three plant families were lower than those of phyllosphere fungi and isolated 32 species + 2 varieties belonging to 21 genera, 32 species belonging to 18 genera and 28 species + one variety belonging 13 genera, from five plants of each of *Labiatae*, *Solanaceae*, *Umbelliferae*, respectively. *Aspergillus*, *Alternaria*, *Cochliobolus* and *Cladosporium* were the most common genera of phylloplane fungi isolated from the four localities. *Aspergillus japonicus*, *A. flavus*, *A. versicolor*, *Alternaria alternata*, *Cochliobolus spicifer*, and *Cladosporium cladosporioides* were the most prevalent species of the above mentioned genera. These fungi were recorded as the most common phylloplane fungi present on the leaf surface on many plants in Egypt^{6,20,22} as well as in many parts of the world^{7,26}. *Penicillium*, *Emericella* and *Stemphylium* were recorded with high frequencies from only three localities while, *Chaetomium* and *Rhizopus* were isolated with high occurrence from only two localities out of four. On the other hand, *Fusarium* isolated with high occurrence from PF only. The most common species of these genera were *Penicillium chrysogenum*, *Emericella nidulans*, *Stemphylium botryosum*, *Chaetomium globosum* and *Rhizopus stolonifer*. Most of these species were previously isolated as phylloplane fungi from leaf surface of some plants^{8,20,22}. *Epicoccum nigrum* was isolated with moderate frequency from PF only while, *Ulocladium botrytis*, *Botryotrichum piluliferum* and *Nigrospora sphaerica* were recovered with moderate occurrence from WA only. The remaining genera and species were recovered in less frequency. It can be concluded from this study that the results of phylloplane fungi were very close to those of phyllosphere but with a few observations, the first was that narrowest spectra of genera, species and species varieties (32 genera, 75 species and 5 species varieties) were recorded as phylloplane compared to those recorded as phyllosphere fungi (41 genera, 107 species and 6 species varieties). Also, numerous genera and species of fungi were recovered only as phyllosphere (such as *Aspergillus sulphureus*, *Cochliobolus sativus*, *C. tuberculatus*, *Fusarium indica*, *Fennellia nivea*, *Fusarium chlamydosporum*, *Mucor racemosus*, *Paecilomyces lilacinus*, *Penicillium oxalicum*, *P. expansum*, *P. capsulatum*, *P. camemberti*, *Stachybotrys elegans*, *Trichoderma koningii*, *Pithomyces atro-olivaceus*, and *Ulocladium atrum*) comparable to those as phylloplane. On the other hand, few genera and species such as *Arthrimum sacchari*, *Eurotium repens* and *Trimmatostroma eriodictyonis* were recorded only from phylloplane. Interestingly, Three species namely, *Arthrimum sacchari* which was isolated from phylloplane of Guava plant (*Psidium guajava* L.) that was cultivated in WA, *Papulaspora immersa* which was isolated from phyllosphere of wheat (*Triticum aestivum* L.) plants cultivated in WA and one unidentified ascomycete that was isolated from phyllosphere of pomegranate (*Punica granatum* L.) cultivated also in WA are new records and isolated for the first time in Assiut, Egypt²⁷.

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