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Original Paper

Seasonal fluctuation of freshwater ascomycetes in Nile Delta region (Egypt)

Ahmed M. Abdel-Raheem[1], Gamalat A. Abd-Elaah[1], Osman M. El-Maghraby[1] and Mahmoud S. Bakhit[1]

[1]Botany department, Faculty of Science, Sohag University.

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Abstract

Seasonality of freshwater ascomycetes was studied in Nile Delta region from February 2010 to December 2011. One hundred and ten ascomycetes were identified through this investigation. The most common ascomycetes recovered during fluctuation study of Delta region were *Zopfiella latipes*, *Microthelia* sp. 1, *Helicascus aegyptiacus* and *Naïs aquatica*. Physico-chemical analysis (Water temperature, pH, concentration of NH_3, NO_2^- and PO_4^{3-}) were recorded and had significant effect during this study.

Key word: Freshwater, ascomycetes, Delta region.

Introduction

Aquatic fungi are universally distributed occurring from Arctic to tropical waters (Jones and Pang, 2012). Freshwater fungi comprise a cosmopolitan and phylogenetic diverse group (McLaughlin *et al.*, 2001) and consist mostly of microfungi, including meiosporic ascomycetes and mitosporic ascomycetes (Shearer, 1993, 2001). Freshwater ascomycetes are an ecological assemblage of fungi that occur on submerged or partially submerged substrates in aquatic habitats (Shearer, 2001; Vijaykrishna *et al*., 2006). Some freshwater ascomycetes are cosmopolitan in distribution, while others are reported only from their type localities (Shearer, 1993, 2001; Cai *et al*., 2006). About 500 species of meiosporic euascomycete species have been reported from freshwater and this group consists of species of Discomycetes, Loculoascomycetes and Pyrenomycetes in a proportion of 111:143:246 (Shearer *et al*., 2007).

Freshwater environments show wide variations in terms of their physical and chemical characteristics. The season of sampling is one of the main factors affecting colonization and diversity of freshwater fungi (Cai *et al*., 2003; Luo *et al*., 2004; Nikolcheva and Bärlocher, 2005). Most of the fungal species can be collected throughout the year, but their richness and relative abundance are influenced by the seasonal availability of the woody substrates in temperate regions (Bärlocher, 1992 a, b, c). Seasonal changes in the temperature have been shown to effect fungal species richness and diversity (Suberkropp, 1984; Bärlocher *et al*., 2008; Luo *et al*., 2004). illustrated that differences in fungal communities and richness at different seasons were insignificant even though the summer and winter are distinct (high versus low rainfall) in the Kunming region (Southwest China).

Seasonal patterns and succession of fungi in freshwater habitat has been studied in many sectors of the world (Hughes, 1962; Alabi, 1971; Iqbal and Webster, 1973; Lamore and Goos, 1978; Suberkropp, 1984; Aimer and Segedin, 1985; Thomas *et al*., 1989, 1992; Khulbe, 1991; Shearer and Webster, 1991; Sridhar and Bärlocher, 1993; Fallah, 1999; Sivichai *et al*., 2000; Tsui *et al*., 2001; Ho *et al*., 2002; Luo *et al*., 2004).

In Egypt, while numerous investigations have been conducted dealing with the seasonal

* Corresponding author:
Dr. Ahmed M. Abdel-Raheem
✉ a.abdel-rahem@mailcity.com

occurrence of zoosporic fungi and aquatic hyphomycetes in various water habitats (Abdel-Raheem, 1988, 1992; El-Hissy *et al*., 1982, 1990, 2000; Khalil *et al.*, 1993, 1995) and myxomycetes (Saad-Elden, 2008). There are no studies were conducted on the seasonal fluctuation of higher freshwater fungi on decaying plant materials in Nile Delta region.

Materials and Methods:

Study area:

The studied area (Nile Delta) lies between latitude 30° 08´ S and 31° 20´ N and between longitudes 30° 54´W and 31° 45´ E (Fig. 1). The Delta has a Mediterranean climate, characterized by little rainfall. The delta temperatures were averaging 30-48 °C and 10-19 °C in summer and winter, respectively. Usually it is rains and humid in winter (Elewa, 2010).

Samples collection, preparation and examination:

Submerged and decaying plant substrates (3318 sample) were collected periodically from River Nile and irrigation canals in the period from February 2010 to December 2011. Cleaned samples were incubated at room temperature with the diffuse of light in moist chamber or clean transparent plastic bags. Cultures were sprayed by sterile distilled water from time to time to avoid dryness of the samples. Sterile water can be sprayed by using a fine aerosol spray. Samples examined periodically for about 4-6 months. Cultures were checked for sporulating structures using a dissecting microscope (Olympus SZ61 or model Tl2, CE Olympus Co, Ltd). Water Samples were collected for hydrochemical analysis in clean polyethylene bottles from most sampling sites in the four season's collections.

Data analysis:

Frequencies of occurrence of each species were calculated. Shannon-Weiner index (Shannon and Weaver, 1963) was applied to evaluate the diversities of freshwater ascomycetes in the different four seasons. The Jaccard's and Sørenson's similarity indices (Jaccard 1908; Sørenson, 1949). were used to compare the similarity of the species composition between the different seasons. Calculations were carried out according to Magurran (1988).

1. **1.** Frequency of occurrence of each fungus (%) was calculated on the following formula = (Number of samples that a particular species occurred on / Total number of examined samples) x 100
2. **2.** Shannon-Weiner index (α-diversity) was calculated for each studied area by using Shannon's formula (Shannon and Weaver 1963).

$$(H') = - \sum Pi \log Pi,$$

Where Pi is the relative abundance of a particular species (the proportion of the total number of individuals represented by species i).

3. **3.** Jaccard's and Sørenson's similarity indices were used to compare the similarity of the species composition between seasons collection. Sørenson's and Jaccard's similarity indices were calculated according to the formula:

Sørenson similarity index (Cs) = $2C/(a+b)$.

Jaccard similarity index (Cj) = $C/(a+b-c)$.

Where **C** = number of species common to both sites, **a** = total numbers of species in site **1, b** total numbers of species in site 2. These indices are designed to equal 1 in absolute similarity and 0 if the sites are dissimilar and have no species in common.

Fig. (1): A map showing the location of studied area in Nile Delta region

Results:

Seasonally changes in averages of physical and chemical parameters of water samples on the different season's collection are presented in table (1). One hundred and ten ascomycetes species representing 58 genera were identified from samples collected periodically from Nile Delta region in the period from February 2010 to December 2011. A list of species, frequency of occurrence of each species in the studied four seasons is given in table (2). Number of ascomycetes species was fluctuated between 53 (February 2010) and 67 (August 2010). Number of ascomycetes records was declined to the lowest value in February 2010 (311 records) and was high in May 2011 collection (552 records) as shown in table (3).

The most common ascomycetes species in Nile Delta region were *Zopfiella latipes*, reported on (6.99%) of the total collected submerged samples and *Microthelia* sp. l (4.77), *Helicascus aegyptiacus* (*2.49%)* and *Naïs aquatica* (*2.46%)* (Table 2). Twenty-two (20%) ascomycetes were collected throughout the entire year while, thirty-six species (32.7%) were reported in one season without others. Number of unique species and list of exclusively reported ones in each season were listed in table (4).

Sordariomycetes and Dothideomycetes dominate the ascomycete assemblage in Delta region. The highest number of Sordariomycetes species (41 species) was reported in May 2011 collection while; the highest number of Dothideomycetes species (21 species) was in August collection (Fig. 2). Discomycetes was reported by only three species in May 2011. *Zopfiella* and *Leptosphaeria* were the most common genera in August 2010 collection, were represented by 159 and 44 records, respectively. *Nais* and *Zopfiella* were more common in May 2011 collection. *Achaetomium and Kirschsteiniothelia* were the most common genera in December 2011 collection (Table 2).

Some freshwater ascomycetes species were more common in particular seasons e.g. Zopfiella latipes was more common in August 2010 (16.5% of the total collected samples), *Naïs aquatica* in May 2011 5.99, *Microthlia* sp. 1 in February 2010 (6.2%), *Helicascus aegyptiacus* in December 2011 (5.36%) (Table 2).

Seasons	Physical properties			Chemical propertiess						
	W.T ^0C	pH	TDS ppm	Cl^- ppm	Ca^{2+} Ppm	Mg^{2+} ppm	SO_4^{2-} ppm	NO_2^- ppm	NH_3 ppm	PO_4^{3-} ppm
February 2010	16-18	6.9	308.3	17.84	39.8	20.4	33.7	0.02	0.31	0.13
August 2010	27-29	6.3	353.8	44.9	42.6	22.5	27.1	0.06	1.17	0.17
May 2011	20-22	7.46	184.3	31.21	32.5	19.5	25.2	0.03	0.21	0.07
December 2011	10-12	7.5	345	42.5	32.8	17.3	39.0	0.05	0.2	0.04

Table (1): averages of physico-chemical parameters on the different season's collection.

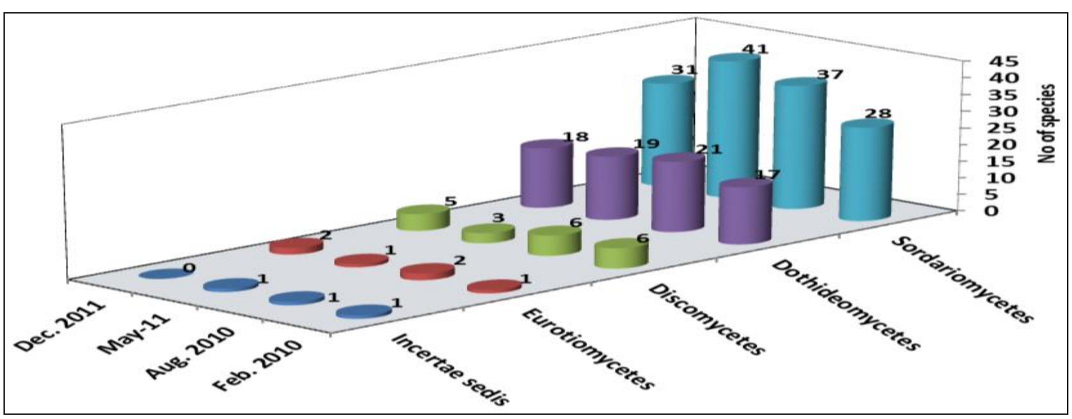

Fig. (2): Proportion of the ascomycetes classes in the studied seasons.

Species Name	Feb. 2010	Aug. 2010	May 2011	Dec. 2011	Total
Achaetomium	***2.63***	***4.84***	***3.16***	***5.24***	***3.96***
Achaetomium globosum JN Rai & JP Tewari	*2.38*	*0.62*	-	*4.52*	*1.86*
Achaetomium umbonatum K Rodr, Stchigel & Guarro	-	-	-	*0.36*	*0.09*
Achaetomium sp.	*0.25*	*4.22*	*3.16*	*0.36*	*2.01*
Aliquandostipite separans (Abdel-Wahab & El-Shar.) J. Campb., Raja, A. Ferrer, Sivichai & Shearer	-	-	*0.45*	-	*0.12*
Aniptodera	***2.51***	***1.74***	***4.52***	***1.19***	***2.52***
Aniptodera aquadulcis (SY Hsieh, HS. Chang & EB Jones) J Campb., JL Anderson & Shearer	*0.88*	*0.50*	*2.15*	-	*0.9*
Aniptodera chesapeakensis Shearer & MA Mill.	*1.25*	*0.74*	*2.03*	*1.07*	*1.29*
Aniptodera inflatiascigera KM Tsui, KD Hyde & Hodgkiss Hodgkiss	-	*0.50*	*0.11*	-	*0.15*
Aniptodera margarition Shearer	*0.13*	-	*0.23*	-	*0.09*
Aniptodera sp.	*0.25*	-	-	*0.12*	*0.09*
Annulatascus	-	***1.24***	***0.68***	***0.24***	***0.54***
Annulatascus licualae J. Fröhl. & KD Hyde	-	*0.62*	*0.11*	-	*0.18*
Annulatascus nilensis Abdel-Wahab & Abdel-Aziz	-	*0.12*	*0.23*	*0.24*	*0.15*
Annulatascus palmietensis Goh, KD Hyde & Steinke	-	*0.50*	-	-	*0.12*
Annulatascus sp.	-	-	*0.34*	-	*0.09*
Anthostomella sp.	*0.13*	-	-	-	*0.03*
Apiosordaria terrestris (SC Jong and EE Davis) JC Krug, Udagawa &	*0.13*	-	-	-	*0.03*
Arnium mendax N Lundq.	-	-	*0.11*	-	*0.03*
Ascobolus	***0.63***	***0.5***	***0.79***	***0.24***	***0.54***
Ascobolus calesco AE Bell & Mahoney	-	*0.25*	-	-	*0.06*
Ascobolus castaneus Teng, Sinensia	*0.25*	-	-	*0.12*	*0.09*
Ascobolus behnitziensis Kirschst.	*0.38*	*0.25*	*0.79*	*0.12*	*0.39*
Astrosphaeriella aosimensis I. Hino & Katum.	*0.25*	-	-	*0.24*	*0.12*
Bombardia hyalina GS Verma	*0.38*	*0.12*	*1.24*	-	*0.45*
Caryospora	***0.5***	***0.37***	***0.34***	***1.31***	***0.63***
Caryospora sp. 1	*0.25*	*0.37*	*0.34*	*1.19*	*0.54*
Caryospora sp. 2	*0.25*	-	-	*0.12*	*0.09*
Cercophora costaricensis (GC Carroll & Munk) O Hilber and R Hilber	-	*0.62*	-	-	*0.15*
Chaetomium	***2.25***	***1.86***	***2.83***	***2.62***	***2.4***
Chaetomium bostrychodes Zopf	-	*0.87*	*2.49*	-	*0.87*
Chaetomium globosum Kunze	*1.5*	*0.37*	*0.11*	*0.95*	*0.72*
Chaetomium sp. 1	*0.75*	*0.25*	-	*1.67*	*0.66*
Chaetomium sp. 2	-	*0.37*	*0.23*	-	*0.15*
Cosmospora sp.	-	*0.37*	*0.11*	-	*0.12*
Emericella nidulans (Eidam) Vuill.,	-	*0.37*	-	-	*0.09*
Falciformispora sp.	-	-	*0.11*	-	*0.03*
Halosarpheia heteroguttulata SW Wong, KD Hyde & EB Jones	*1.5*	*1.36*	*0.57*	*0.36*	*0.93*
Iodophanus	***0.63***	-	-	***0.36***	***0.24***
Iodophanus carneus (Pers.) Korf	-	-	-	*0.36*	*0.09*
Iodophanus testaceus (Moug.) Korf	*0.63*	-	-	-	*0.15*
Jahnula	-	***0.49***	***0.9***	***0.36***	***0.45***

Table (2): Frequency of occurrence of ascomycetes species in the studied seasons.

Species Name	Feb. 2010	Aug. 2010	May 2011	Dec. 2011	Total
Jahnula aquatica (Kirschst.) Kirschst.	-	-	0.34	0.12	0.12
Jahnula australiensis K.D. Hyde	-	0.12	-	-	0.03
Jahnula granulosa KD Hyde & SW Wong	-	-	0.11	-	0.03
Jahnula poonythii KD Hyde & SW Wong	-	0.12	-	-	0.03
Jahnula sangamonensis Shearer & Raja	-	-	-	0.12	0.03
Jahnula sp. l	-	0.25	-	-	0.06
Jahnula sp. 2	-	-	0.34	0.12	0.12
Jahnula sp. 3	-	-	0.11	-	0.03
Jobellisia viridifusca KM Tsui & KD Hyde	-	-	-	0.12	0.03
Helicascus aegyptiacus Abdel-Wahab & Abdel-Aziz	0.63	0.25	3.5	5.36	2.49
Leptosphaeria	**3.51**	**5.46**	**4.75**	**7.98**	**5.43**
Leptosphaeria agnita	3.38	0.62	1.70	2.98	2.16
Leptosphaeria xerophylli Ellis	-	4.34	-	-	1.05
Leptosphaeria sp.	0.13	0.5	3.05	5.0	2.22
Lindgomyces sp.	-	-	-	0.24	0.06
Linocarpon sp.	-	-	0.23	0.12	0.09
Lojkania dimidiata ZQ Yuan & ME Barr	0.25	0.37	0.23	0.36	0.3
Lophiostoma sp.	-	-	2.03	2.14	1.08
Lophodermium sp.	1.38	0.74	1.70	0.83	1.17
Lulworthia	**0.63**	-	**1.13**	**1.19**	**0.75**
Lulworthia grandispora Meyers	0.63	-	1.13	0.95	0.69
Lulworthia medusa var. *biscaynia* Meyers	-	-	-	0.24	0.06
Massarina	**0.13**	-	**0.11**	-	**0.06**
Massarina australiensis KD Hyde	0.13	-	-	-	0.03
Massarina fluviatilis Aptroot & Van Ryck.	-	-	0.11	-	0.03
Microascus	**0.25**	**0.37**	**0.34**	**0.24**	**0.3**
Microascus cinereus CA Fuentes & FA Wolf	0.25	-	0.23	0.12	0.15
Microascus trigonosporus CW Emmons & BO Dodge	-	0.37	0.11	0.12	0.15
Micropeltopsis quinquecladiopsis EB Jones, Sivichai & Hywel-Jones Hywel-Jones	-	0.37	-	-	0.09
Microthelia	**6.25**	**3.35**	**4.75**	**5.12**	**4.86**
Microthelia sp. l	6.25	3.35	4.75	4.76	4.77
Microthelia sp. 2	-	-	-	0.36	0.09
Minutisphaera fimbriatispora Shearer, AN Mill. & A Ferrer	0.38	0.50	0.34	-	0.3
Munkovalsaria donacina (Niessl) Aptroot	0.13	0.50	-	-	0.15
Naïs aquatic KD Hyde	0.25	1.61	5.99	1.67	2.46
Natantispora retorquens C (Shearer & JL Crane) J.ampb, JL.	3.0	0.87	3.96	1.43	2.34
Necteria sp.	-	-	0.68	-	0.18
Neocosmospora haematococca (Berk. & Broome) Nalim,	-	0.25	-	-	0.06
Neomassariosphaeria sp.	-	-	-	0.48	0.12
Neonectria sp. 1	0.25	0.25	0.57	0.48	0.39
Ophioceras	**1.88**	**0.37**	**1.47**	**1.2**	**1.23**
Ophioceras commune Shearer, JL Crane & W. Chen	0.38	0.25	0.90	0.24	0.45
Ophioceras fusiforme Shearer, JL. Crane & W. Chen	1.25	-	0.57	0.36	0.54
Ophioceras hongkongense KM Tsui, HY. Leung, KD Hyde Hodgkiss Hodgkiss	0.25	0.12	-	0.60	0.24
Orbilia	**1.25**	**0.75**	**0.11**	**0.12**	**0.54**
Orbilia caudate Starbäck	-	0.50	0.11	-	0.15

Table (2) continued.

Species Name	Feb. 2010	Aug. 2010	May 2011	Dec. 2011	Total
Orbilia sp.	1.25	0.25	-	0.12	0.39
Phaeosphaeria	**1.26**	**1.12**	**1.02**	**0.6**	**0.99**
Phaeosphaeria oryzae I. Miyake	0.63	-	0.68	-	0.33
Phaeosphaeria typharum (Desm.) L. Holm	0.25	0.50	-	0.60	0.33
Phaeosphaeria vagans (Niessl) OE Erikss.	0.38	0.62	0.34	-	0.33
Pleoseptum sp.	0.25	-	-	-	0.06
Pleospora	**0.63**	**0.75**	**1.13**	**2.26**	**1.2**
Pleospora phaeocomoides (Berk. & Broome) G. Winter	0.25	-	-	-	0.06
Pleospora vagans Niessl	-	0.25	0.45	1.31	0.51
Pleospora sp. 1	0.38	0.25	0.68	0.95	0.57
Pleospora sp. 2	-	0.25	-	-	0.06
Podospora	**0.51**	**1.85**	**3.17**	**2.74**	**2.1**
Podospora off. *Pyriformis* (Bayer) Cain	0.25	-	0.57	-	0.21
Podospora communis (Speg.) Niessl	-	0.12	1.47	-	0.42
Podospora dolichopodalis JH Mirza & Cain	0.13	1.12	0.23	1.43	0.72
Podospora glutinans (Cain) Cain	-	0.37	-	-	0.09
Podospora spinulosa RS Khan & Cain	-	0.12	-	1.31	0.36
Podospora sp. 1	-	-	0.9	-	0.24
Podospora sp. 2	0.13	0.12	-	-	0.06
Porosphaerellopsis sp. 1	0.13	-	0.34	-	0.12
Pseudohalonectria	**0.13**	**0.25**	**0.23**	**0.24**	**0.21**
Pseudohalonectria lignicola Minoura & T. Muroi	0.13	-	0.23	0.24	0.15
Pseudohalonectria sp. 1	-	0.25	-	-	0.06
Rivulicola incrustata KD Hyde, in Hyde, Read, Jones & Moss	0.13	-	-	0.12	0.06
Roumegueriella rufula (Berk. & Broome) Malloch & Cain	-	-	-	0.48	0.12
Saccobolus citrinus Boud. & Torrend	0.13	0.25	-	-	0.09
Savoryella	**0.13**	**0.24**	**0.22**	**0.48**	**0.27**
Savoryella aquatica KD Hyde	-	0.12	0.11	0.24	0.12
Savoryella lignicola EB Jones & RA Eaton	0.13	0.12	0.11	0.24	0.15
Schizothecium sp.	-	-	0.34	0.12	0.12
Sporormiella lata (Griffiths) S.I. Ahmed & Cain	-	0.12	-	-	0.03
Togninia minima (Tul. & C. Tul.) Berl.	-	0.25	0.11	-	0.09
Westerdykella	**0.25**	**1.74**	**1.02**	**2.74**	**1.44**
Westerdykella dispersa (Clum) Cejp & Milko	0.25	1.49	1.02	2.74	1.38
Westerdykella multispora (Saito & Minoura) Cejp & Milko	-	0.25	-	-	0.06
Zopfiella	**2.75**	**19.72**	**6.1**	**4.88**	**8.28**
Zopfiella cephalothecoidea Guarro, Abdullah, Al-Saadoon & Gené Gené	-	-	0.34	-	0.09
Zopfiella karachiensis (S.I. Ahmed & Asad) Guarro	-	3.22	1.24	0.36	1.2
Zopfiella latipes (N. Lundq.) Malloch & Cain	2.75	16.5	4.52	4.52	6.99
Zygopleurage	-	**0.37**	**0.11**	-	**0.12**
Zygopleurage multicaudata Mirza	-	0.12	0.11	-	0.06
Zygopleurage zygospora (Speg.) Boedijn	-	0.25	-	-	0.06
Unidentified Ascomycetes sp. 1	-	0.37	0.34	-	0.18
Unidentified Ascomycetes sp. 2	1.0	0.37	0.45	0.36	0.54
Unidentified Ascomycetes sp. 3	-	0.12	0.11	-	0.06

Table (2) continued.

N = Records number; FO = frequency of occurrence; FA= Frequency of appearance of each species in the studied seasons.

Temporal fungal distribution of freshwater fungi in Delta region patterns was difficult to be observed because many species were reported by single record and other many had a very low frequency of occurrence as shown in dominance-diversity curves (Fig. 3). Statistically, there was no significant differences between season's fungal communities (P = 0.67) (using Kruskal-wallis one way analysis of variance) in Nile Delta region.

Shannon-Weiner indices were calculated based on the number of species and individuals. The results show that the differences in the fungal diversity among the four collections are insignificant. Species Shannon-Weiner indices ranged from 3.17 to 3.5 in the studied seasons. Summer collection had the lowest diversity value, while spring and autumn collection had the highest ones (Table 3).

Diversity	Feb-10	Aug-10	May-11	Dec-11
No of collected samples	794	806	879	839
No. of ascomycetes species	53	67	65	56
Ascomycetes Individuals	311	463	552	472
Shannon-Wiener index	3.3	3.17	3.5	3.35

Table (3): Distribution of freshwater ascomycetes in studied season's collections.

Similarity indices were calculated among studied season's collections to evaluate the similarity of freshwater fungal communities at different times. Similarity matrix of Jaccard's and Sørensen's coefficient indexes revealed that there are no clear differences between fungal communities of seasonal collections (Table 5). Species similarity was greatest between December 2011 and February 2010 communities. Jaccard's and Sørensen’s coefficient of similarity of these seasons was 47% and 64% respectively. The summer and autumn collections shared less similarity (Jaccard 34%; Sørensen 51%) as shown in table (5).

February 2010	**August 2010**	**May 2011**	**December 2011**
Anthostomella sp.	*Annulatascus palmietensis*	*Aliquandostipite separans*	*Achaetomium umbonatum*
Apiosordaria terrestris	*Ascobolus calesco*	*Annulatascus* sp.	*Jahnula sangamonensis*
Iodophanus testaceus	*Cercophora costaricensis*	*Arnium mendax*	*Jobellisia viridifusca*
Massarina australiensis	*Emericella nidulans*	*Falciformispora* sp.	*Lindgomyces sp.*
Pleoseptum sp.	*Jahnula australiensis*	*Jahnula granulosa*	*Lulworthia medusa*
Pleospora phaeocomoides	*Jahnula poonythii*	*Jahnula sp. 3*	*Microthelia* sp. 2
	Jahnula sp. l	*Massarina fluviatilis*	*Neomassariosphaeria* sp.
	Leptosphaeria xerophylli	*Necteria* sp.	***Roumegueriella rufula***
	Neocosmospora haematococca	***Podospora*** sp. 1	
	Pleospora sp. 2	*Zopfiella cephalothecoidea*	
	Podospora glutinans		
	Pseudohalonectria sp. 1		
	Sporormiella lata		
	Westerdykella multispora		
	Zygopleurage zygospora		
6	**15**	**10**	**8**

Table (4): List of the unique ascomycetes species for each of the studied season's collections.

Season	Feb. 2010	Aug. 2010	May 2011	Dec. 2011
Feb. 2010	1.00			
Aug. 2010	0.39 (0.56)	1.00		
May. 2011	0.37 (0.54)	0.38 (0.55)	1.00	
Dec. 2011	0.47 (0.64)	0.34 (0.51)	0.39 (0.56)	1.00

Table (5): Similarity matrix of Jaccard's and Sørensen's Coefficient indexes between seasons communities.

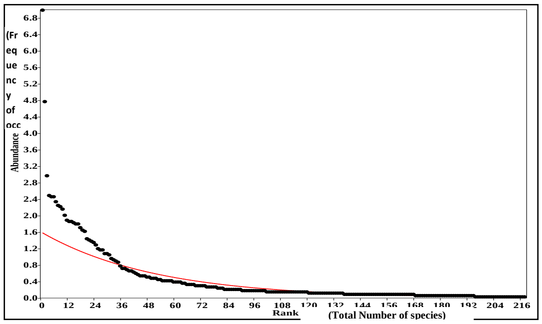

Fig. (3): Dominance diversity curves for total collected species in the different season in Nile Delta region

Discussion

A total of 110 ascomycetes species were identified from 3318 samples collected periodically from Delta region in the period from February 2010 and December 2011. In the current study we had high number and diversity of ascomycetes when compared with previous studies in Egypt or other countries. Differences in ascomycetes communities and species richness between the different seasonal collection in Nile delta region were statistically low significant. Twenty-two species of freshwater ascomycetes were collected throughout the entire year in Nile Delta region. The highest species richness, number of records was observed in August 2010 and May 2011 collections. Lamore and Goos (1978). noted that fungal species richness on naturally occurring wood samples submerged in a temperate stream was highest in September, following a period of heavy rainfall. Seasonal changes in the temperature have been shown to effect fungal species richness and diversity (Suberkropp 1984; Bärlocher *et al.*, 2008). Fallah (1999) illustrated that species numbers of ascomycetes of north temperate lakes in Wisconsin were highest in May and June from 1995 to 1997 and the lowest numbers of fungi occurred in the months of January and February when the lakes were frozen.

Insignificant differences in diversity indexes between fungal communities of seasons were observed in this study and these similar to previous studies (Tsui *et al*., 2001; Sivichai *et al*., 2000). Ho *et al*., (2002) observed that higher species richness, fewer dominant fungi and more infrequent fungi were found on naturally occurring submerged wood during the hot wet season, as compared to the cool dry season in Tai Po Kau Forest Stream, Hong Kong.

Some common freshwater fungi species were dominant in specific seasons. Thirty six species of freshwater fungi in Nile Delta were reported by one record in winter collection. A large number of freshwater fungi recorded on submerged wood in this and previous studies are infrequent taxa (Shearer and Crane, 1986; Shearer and Webster, 1991).

The seasonal fluctuation of freshwater ascomycetes in Nile Delta region gets back to changes in climatic and water physico-chemical parameters in the studied seasons. Water temperature reached to maximum of 29 ^{0}C on August 2010 collection, and was at 10 ^{0}C on December 2011. Concentration of ammonia, NO_2^- and PO_4^{3-} was high in August 2010 collection. The aquatic fungal communities have been found to be effected by variations in temperature (Shearer, 1972; Iqbal and Webster, 1977; Suberkropp, 1984). Chamier (1992) reviewed a number of important factors that effect on the fungal communities inside the stream such as water temperature, conductivity, pH, nitrate and phosphorus concentration. Furthermore, riparian vegetation had been regarded as an important factor influencing freshwater fungal communities (Fabre 1996; Tsui *et al*., 2000).

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الملخص العربي

التنوع الموسمي للفطريات الزقيه في المياه العذبة بمنطقة دلتا النيل (مصر)

تمت دراسة التوزيع الموسمي لمائة وعشرة فطراً زقيا معرفه ومعزولة من عينات نباتية متحللة مغمورة في مياه النيل جمعت موسميا في الفترة من فبراير 2010 إلى ديسمبر 2011 من دلتا مصر. كانت أكثر الأنواع الزقيه شيوعا ذوبيفيللا لاتيبس، نوع ميكروثيليا، وهيلكاسكس إجيبتياكس و نايس اكواتيكا. الخصائص الفيزوكيميائية لمياه نهر النيل (درجة حرارة المياه، تركيز أيون الهيدروجين، تركيز الامونيا، النيتريت والفوسفات) تم تقديرها وأظهرت تأثيرا علي التنوع الفطري في منطقة الدلتا.