Qatar Univ. Sci. Bull. (1983), 3: 131 - 139

AIR-BORNE FUNGI OF WHEAT FIELDS IN EGYPT

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Key Words: Glycophilic (1% glucose), Mesophilic and Osmophilic (50% sucrose) air borne fungi.

ABSTRACT

The air borne fungi of wheat fields in El-Minya Governorate were studied during the periods January-May 1977 and December 1977-May 1978 using the plating catch method on 1% glucose and 50% sucrose-Czapek's agar. Fifty-two species and 24 genera were collected on the two types of media tested. The total counts of air-borne fungi displayed seasonal periodicities and the highest counts were estimated in March 1977 and 1978. The most frequent genera were *Aspergillus* (7 spp.), *Alternaria* (2 spp.), *Cladosporium* (2 spp.), *Penicillium* (2 spp.) and *Fusarium* (*F. solani* only) on 1% glucose and 50% sucrose Czapek's agar media. Their counts showed almost regular seasonal fluctuations during the experimental periods.

INTRODUCTION

Air-borne fungi have been studied by several workers in different places of the world (Gregory & Hirst, 1952 & 1957; Gregory, 1954; Pady & Kapica 1955, Daves 1957; Ripe 1962; Taylor & Mac-Fadden 1962; Dransfield, 1966; Eversmerer & Kramer, 1975; Popescu *et al.* 1975 and several others).

In Egypt several investigations have been accomplished on the air-borne fungi in various cities (Saad, 1958; Zaky, 1960; Adel-Rahman, 1973; Abou-El-Soud, 1974; Moubasher and Moustafa, 1974; Abdel-Gawad, 1978; Moubasher *et al.* 1981 and Mazen *et al.* 1982), but none of them studied air fungi of fields cultivated with particular crop. The present investigation reports on the incidence of air-borne fungi in wheat fields in El-Minya Governorate, Egypt.

MATERIALS AND METHODS

Ten plates of 9 cm diameter, five of them contained glucose-Czapek's agar + rose bengal as bacteriostatic agent (Smith and Dawson, 1944) and the other five plates contained 50% sucrose-Czapek's agar + rose bengal, were exposed to the air in wheat fields in El-Minya Governorate every fortnight during the periods, January - May 1977 and December 1977 - May 1978 which are the periods of field. The plates were exposed for five minutes between 1-2 p.m. and transferred immediately to the laboratory and incubated at 28°C for 7-10 days during which the developing fungi were identified and counted. The colonies of slow growing fungi which were about to be overgrown by fast-growing fungi were transferred to slants or plates of fresh agar medium to ensure precise counting and identifications.

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RESULTS AND DISCUSSION

A: On 1% glucose-Czapek's agar (Table 1):

Forty-four species and 22 genera were collected from the air of wheat fields. All of these genera and species were isolated previously from soils, seeds, grains, roots and leaf surfaces of some Egyptian plants as reported by Moubasher and his collaborators.

The total counts of air-borne fungi displayed seasonal periodicities and the highest counts were estimated in March 1977 and 1978 and lowest in May 1978 (Fig. 1). *Aspergillus, Alternaria Cladosporium, Humicola, Fusarium, Penicillium & Epicoccum* were isolated in high frequency of occurrence. These genera were also common in the air of Assiut (Moubasher & Moustafa, 1974; Abu-El-Soud 1974; Abdel-Gawad 1978 and Mazen *et al.* 1982), Qena (Moubasher *et al.* 1981) and Wadi-Bir. El-Ain (El-Maghraby, 1980). Most of these genera are also dominant in the air of many places of the world (Di-Menna 1955; Vinje & Vinje, 1955; Richards, 1956; Kramer *et al.* 1959 & 1960; Frey & Durie, 1962; Screeramulu and Seshavatarm, 1962; Hudson 1969 and several others).

Aspergillus occurred in all months of the experiment accounting for 28.4% of total fungi. Its count did not exhibit any regular periodicities, but the maxima were recorded in January 1977 (7.4% of total fungi) and March 1978 (3.6%) and the minima in May 1977 and 1978. (Fig. 1). It was represented by 9 species of which *A. niger, A. terreus* and *A. flavus* were of high seasonal occurrence. They emerged in 11, 9 and 6 months comprising 77.4, 11.1 and 1.8% of total *Aspergillus* and 22, 3.2 and 0.5% of total fungi respectively. *A. niger* counts were almost parallel to these of the genus count and the richest month was January 1977 (24.8 and 7.1% of total *Aspergillus* and total fungi repectively). The preceding species were also common in the air of Assuit, (Abdel-Gawad, 1978; Abu-Souod, 1974 and Moubasher & Moustafa, 1974), Qena (Moubasher *et al.* 1981) and Wadi Bir-El-Ain (El-Maghraby, 1980). The remaining *Aspergillus* species were less frequent than the preceding ones (Table 1).

Alternaria was missed only in May 1978, accounting for 12.4% of total fungi. Its count increased regularly between February and April 1977 and 1978 and the maxima were regularly obtained in April 1977 (3.3%) and 1978 (2.9%). Two species were identified of which *A. alternata* was the most common. It occurred in 10 months constituting 48% of total *Alternaria* and 10.5% of total fungal catch. Its counts were almost parallel to those of the genus count and the maxima were recorded in March 1977 (15.3 and 2.03% of total *Alternaria* and total fungi repectively) and April 1977 & 1978 (18.0 and 15.3%; and 2.2 & 1.9% respectively). *A. alternata* was also the most common *Alternaria* species in the air at Assuit, Qena and Wadi Bir-El-Ain (Sohag region) as from soils, seeds, grains, rhizosphere, rhizoplane, phyllosphere and phylloplane of wheat plants as reported by Moubasher and his co-workers.

Cladosporium was a basic component of the air of wheat fields. It was recovered in 9 months but it contributed the denest count among all fungi (20.7%). Its count displayed seasonal periodicities and increased regularly between January and March 1977 and 1978 and the highest counts were regularly recorded in March 1977 (31.4%) and 1978 (22.1%) (Fig. 1).

Cladosporium is one of the commonest fungi in the air in temperature and tropical zones (Hyde and Williams, 1953; Di-Menna 1955; Vinje & Vinje, 1955; Richards, 1956; Gregory & Hirst, 1957; Kramer *et al.* 1959; Frey & Durie, 1962; and Hudson, 1969). Also, it constituted 49.9% of

6 to 9) whereas some other species showed the opposite trend *(Epicoccum purpurascens*, 6 to 3, *A. terreus* 9 to 3).

On conclusions the results of the present investigation indicate that the composition of air-borne fungi in wheat fields in El-Minya Governorate does not considerably differ from those collected from other cities in Egypt where the catch of fungi was not associated with a particular crop.

Table 1

Total average counts (per 5 plates in every sample) of air-borne fungi of wheat fields recovered on 1% glucose-and 50% sucrose-Czapek's agar at 28°C.

Species	1% Glucose			50% Sucrose		
	TC	NCI	OR	TC	NCI	OR
Total count	1205.5			891.5		
Aspergillus	342.5	11	H	380.5	11	H
A. niger Van Tieghem	265.5	11	H	316.5	11	H
A. terreus Thom	38.0	9	H	4.0	3	M
A. flavus Link	6.0	6	H	11.5	6	H
A. fumigatus Fresenius	12.0	5	M	20.5	6	H
A. nidulans (Eidam) Winter	3.0	2	L	0.0	0	0
A. sydowii (Bain. & Sart.) Thom & Church	2.5	2	L	0.0	0	0
A. versicolor (Vuill.) Tirab.	1.5	2	L	0.0	0	0
A. ochraceus Wilhelm	1.5	1	R	12.5	6	H
A. wentii Wehmer	13.0	1	R	0.0	0	0
A. chevalieri (Mangin) Thom & Church	0.0	0	0	7.0	4	M
A. amstelodami (Mangin) Thom & Church	0.0	0	0	5.0	4	M
A. tamarii kita	0.0	0	0	2.5	2	L
A. ustus (Bain.) Thom & Church	0.0	0	0	1.0	2	L
Alternaria	150.0	10	H	58.0	9	H
A. alternata (Fr.) Keissler	126.0	10	H	48.0	8	H
A. grisea Szilvinyi	24.0	2	L	0.0	0	0
A. geophila Desze Wska	0.0	0	0	10.0	3	M
Cladosporium	249.5	9	H	337.0	11	H
C. herbarum (Pers.) Link ex S.F. Gray	154.0	9	H	171.5	9	H
C. cladosporioides Penz	95.5	6	H	165.5	9	H
Humicola	25.5	8	H	13.0	4	M
H. grisea Traaen	20.0	5	M	11.0	3	M
H. fuscoatra Traaen	5.5	4	M	2.0	2	L
Fusarium	28.5	8	H	0.0	0	0
F. solani (Mart.) Appel & Wollen	25.5	7	H	24.5	6	H
F. moniliforme Sheldon	1.0	1	R	1.5	1	R
F. oxysporum Schlecht.	2.0	1	R	0.0	0	0
Penicillium	15.5	8	H	18.5	9	H
P. crysogenum Thom	6.5	4	M	0.0	0	0

Table (1) Cont.

Species	1% Glucose			50% Sucrose		
	TC	NCI	OR	TC	NCI	OR
P. corylophilum Dierckx	5.5	3	M	18.5	9	H
P. nigricans (Bain.) Thom	2.0	2	L	0.0	0	0
P. patulum Bainier	0.5	1	R	0.0	0	0
P. oxalicum Currie & Thom	1.0	1	R	0.0	0	0
Epicoccum purpurascens Ehrenb. ex Schlecht.	23.5	6	H	12.5	3	M
Curvularia	9.0	4	M	0.0	0	0
C. spicifera (Bain.) Boedijn	8.0	4	M	0.0	0	0
C. lunata (Wakker) Boedijn	1.0	1	R	0.0	0	0
Stemphylium botryosum Wallr.	20.5	5	M	32.5	4	M
Scopulariopsis brevicaulis (Sacc.) Bain.	15.0	4	M	0.0	0	0
Trichothecium roseum (Pers.) Link.	5.5	5	M	0.0	0	0
Trimmatostroma salices Corda	4.0	2	L	0.0	0	0
Botryotrichum piluliferum Sacc. & March.	2.0	2	L	0.0	0	0
Ulocladium botrytis Preuss	2.5	2	L	0.0	0	0
Mucor	1.0	2	L	2.0	1	R
M. hiemalis Wehmer	0.5	1	R	2.0	1	R
M. racemosus Fresenius	0.5	1	R	0.0	0	0
Rhizopus stolonifer (Ehrenb. ex Fr.) Lindt	1.0	2	L	1.0	1	R
Acremonium strictum W. Gams	1.0	1	R	1.0	1	R
Drechslera	2.5	1	R	0.0	0	0
D. hawaiiensis (Bugn.) Subram & Jain	0.5	1	R	0.0	0	0
D sativus (Ito & Kurib.) Drechsler	2.0	1	R	0.0	0	0
Myrothecium verrucaria (Albertini & Schweinitz) Ditmer ex Fr.	1.0	1	R	0.0	0	0
Paecilomyces variotii Bainier	1.0	1	R	0.0	0	0
Trichoderma viride Pers. ex S.F. Gray	0.5	1	R	0.0	0	0
Stachybotrys chartarum (Ehrenb. ex Link) Hughes	1.0	1	R	3.0	2	L
Absidia corymbifera (Cohn.) Sacc. & Trott	0.0	0	0	1.5	2	L
Chaetomium bostrychodes zopf	0.0	0	0	3.5	2	L
Sterile mycelium	3.0	4	M	1.0	1	R

TC = Total counts in every sample
NCI = Number of cases of isolation.
OR = Occurrence remarks:
H = High occurrence, between 6-11 cases.
M = Moderata occurrence, between 3-5 cases.
L = Low occurrence, 2 cases.
R = Rare occurrence, 1 cases.

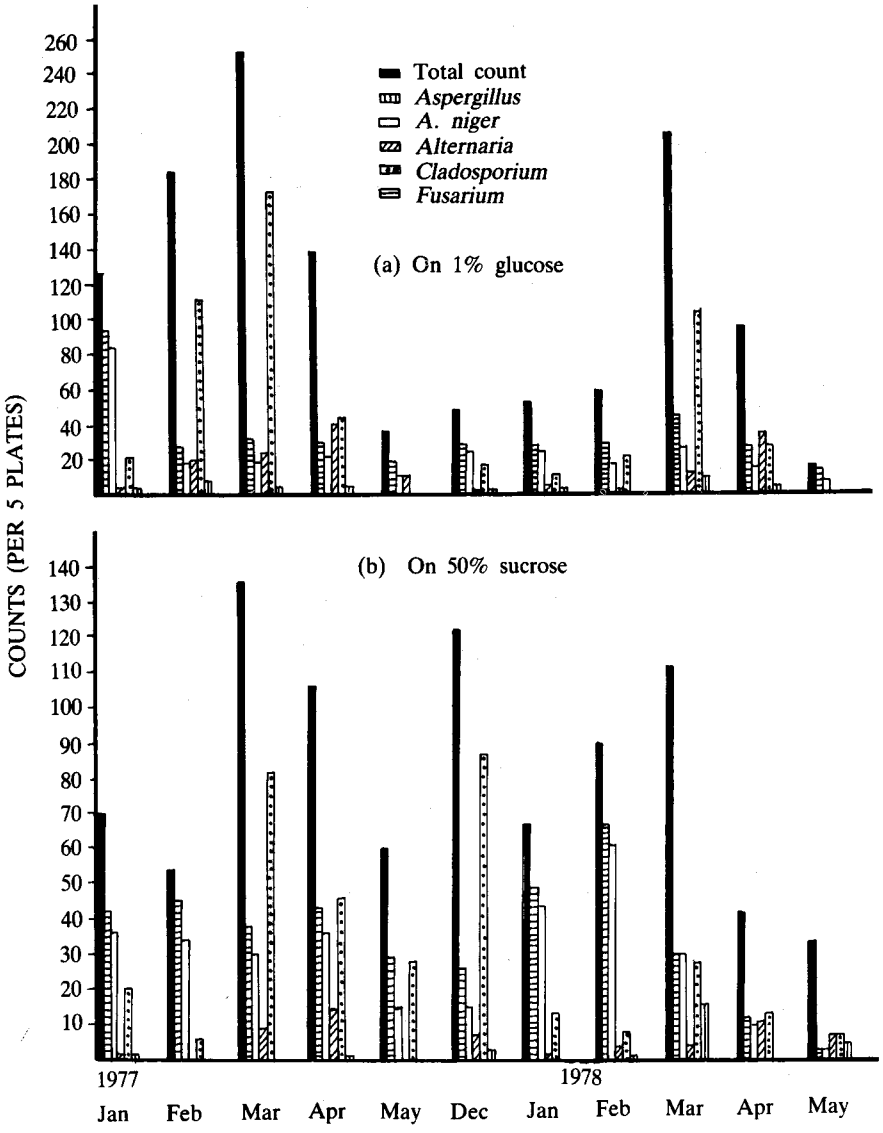

Fig. 1: Monthly average counts (per 5 plates) of common air-borne fungi of wheat field over the periods January-May 1977 and December 1977 - May 1978.

a) Glycophilic fungi (on 1% glucose - Czapek's agar medium) at 28°C (Mesophilic).

b) Osmophilic fungi (on 50% sucrose - Czapek's agar medium) at 28°C (Mesophilic).

total fungi (Moubasher & Moustafa, 1974), 52.8% at low level and 40.7% at high level (Abu-El-Soud, 1974) in Assiut, and 37.1 and 24.6% at low and high levels respectively in Qena (Moubasher *et al.* 1981).

It was represented by 2 species of which *C. herbarum* was the most prevalent which emerged in 9 months yielding 61.7 and 12.8% of total *Cladosporium* and total fungi respectively. Its maximum counts were estimated in March 1977 and 1978 (28.5 and 21.7% of total *Cladosporium* and 13.0 and 9.9% of total fungi respectively). It was also the most common *Cladosporium* species in the air at Assiut (Abu-El-Soud, 1974; Moubasher & Moustafa 1974; Abdel-Gawad, 1978 and Mazen *et al.* 1982), Qena (Moubasher *et al.* 1981) and Wadi-Bir El-Ain (El-Maghraby, 1980). *C. cladosporioides* emerged in 6 months giving rise to 17.4% of total *Cladosporium* and 7.9% of total fungi. Its count did not exhibit any regular periodicities, but the highest count was obtained in February 1977 (8.7 and 4.0% respectively).

Humicola, *Fusarium* and *Pencillium* were recovered each in 18 months comprising 2.12, 2.40 and 1.30% of the total fungi respectively. Their counts irregularly fluctuated, but the highest counts were recorded in April (7.6% of total fungi); March 1978 (3.8%) and February 1977 (2.17%) respectively (Fig. 1). From these genera *H. grisea* (1.7% of total fungi), *F. solani* (2.1%) and *P. corylophilum* (0.5%) were the most prevalent. These species were also recovered in this laboratory from the air in Assiut, Qena and Wadi-Bir El-Ain.

Epicoccum (E. purpurascens) counts irregularly fluctuated in the atmosphere of wheat fields and emerged in 6 months consisting 2.0% of total fungi. Also, this species was recorded in the air of Assiut, Qena and Sohag (Bir El-Ain) in moderate or low frequencies of occurrence (Abu-El-Souod, 1974; Mazen *et al.* 1982. Moubasher *et al.* 1981 and El-Maghraby, 1980).

Four genera were isolated in moderate seasonal frequency of occurence and these were *Curvularia (C. spicifera* and *C. lunata)*, *Stemphylium (S. botryosum)*, *Scopulariopsis (S. brevicaulis)* and *Trichothecium (T. roseum)* which emerged in 4-5 months accounting for 0.5 - 1.7% of total fungi.

The remaining genera and species were of low or rare seasonal occurrence as shown in Table (1).

B - On 50% sucrose-Czapek's agar (Table 1):

The results obtained on 50% sucrose agar are almost similar to those collected on 1% glucose-Czapek's agar which indicates that most of the air-borne fungi are of osmophilic nature (Fig. 1). Comparison between the results obtained on the two media reveals the following:

1. A narrower spectrum of genera (14) and species (28) were recovered on 50% sucrose agar.
2. The dark-coloured fungi predominated on the two types of media over the hyaline ones.
3. Some fungal species such as *A. chevalieri* and *A. amstelodami* were encountered on 50% sucrose agar only. These two species are well known as osmophilic organisms (Raper & Fennell, 1965; Moustafa, 1975; Abdel-Hafez *et al.* 1977; Moubasher *et al.* 1979, and Moubasher *et al.* 1981).
4. Some fungal species increased their frequency of occurrence on 50% sucrose agar than on 1% glucose agar (*A. ochraceus*, 1 to 6 months; *P. chrysogenum*, 2 to 9; *C. cladosporioides*,

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فطـــريات الهواء في حقول القمح في مصـــر

محمد بهي الدين مازن ، جيهان محمد شعبان

درست الفطريات المحمولة في هواء حقول القمح لمحافظة المنيا خلال الفترة من يناير ـ مايو ١٩٧٧ ، ديسمبر ١٩٧٧ ـ مايو ١٩٧٨ مستخدمين طريقة الأطباق التي تحتوي على وسط شابكسى المتصلب والمحتوي على ١٪ جلوكوز أو ٥٠٪ سكروز .

عزل أثناء هذا البحث اثنين وخمسون نوعاً تنتمي إلى أربعة وعشرون جنساً على الأوساط الغذائية وقد لوحظ أن التعداد الكلي للفطريات يتفاوت أثناء التغيرات الموسمية المختلفة وقد سُجل أعلى تعداد فطري في مارس ١٩٧٧م ، ١٩٧٨م كانت أكثر الأجناس انتشاراً هى الاسبرجلس (٧ أنواع) الالترناريا ، كلادوسبوريم ، بنسيليام (نوعين لكل منها) ونوع واحد يتبع جنس الفيوزاريوم (فيوزاريوم سولناى) عند استخدام الوسط الغذائي المحتوى على ١٪ جلوكوز أو ٥٠٪ سكروز .

ولقد أظهرت النتائج غالباً تغيراً موسمياً منتظماً في التعداد الفطري في خلال الفترات المختلفة للتجربة .