MONTHLY VARIATIONS OF *OOMYCETES* (ZOOSPORIC FUNGI) AND AQUATIC *HYPHOMYCETES* AT SOHAG (UPPER EGYPT)

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ABSTRACT

Fifty-eight fungal species related to twenty-six genera of *Perenosporales* and *Saprolegniales* (32 species, 7 genera, 671 colonies) and aquatic *Hyphomycetes* (26 species; 19 genera; 1038 colonies) were recovered from the surface water (zoosporic fungi) and submerged decaying leaves (aquatic *Hyphomycetes*) samples collected monthly (10 samples each month) during the period of experiment (18 months). The richest samples in either zoosporic fungi or aquatic *Hyphomycetes* were those of comparatively low or moderate temperature, high contents of organic matter and dissolved oxygen. The pH value and the total soluble salts did not show any regular monthly variations and did not exhibit any considerable influence on fungal population. *Achlya racemosa*, *Dictyuchus sterile* (*Saprolegniales*) and *Alatospora acuminata*, *Trisclophorus monosporus* (aquatic *Hyphomycetes*) were the most prevalent species. Some fungal species showed their highest population in winter months whereas others in summer months. Moreover, some species were recovered throughout the year. One species of *Saprolegniales* (*Isoachlya toruloides*) and three species of aquatic *Hyphomycetes* (*Exophiala jeanselmei*, *Flabelliospora* Sp. and *Varicosporium delicatum*) are new records to Egypt.

KEY WORDS: Aquatic fungi, Upper Egypt.

INTRODUCTION

Fungi are found in all kinds of aquatic habitats. They live as saprophytes or parasites on plants and animals. Saprophytic fungi grow on decaying plant and animal remains, submerged branches, twigs, fruits and leaves. The occurrence and seasonal variations of either zoosporic fungi in various water areas (e.g. Sparrow, 1968; Nasar and Munshi, 1980; Khulbe, 1980; Misra, 1982 and Klick and Tiffany, 1985) or aquatic *Hyphomycetes* (e.g. Willoughby and Archer, 1973; Webster, 1977; Singh and Musa, 1977; Müller-Haekel and Marvanova, 1979; Chamier and Dixon, 1982; Iqbal et al., 1980 and Baerlocher, 1982) were intensively studied in different geographical regions in the world. Attention is given to the ecology of aquatic *Hyphomycetes* due to their possible importance in processing decaying leaves for subsequent consumption by small aquatic animals is considered. In Egypt, in spite of numerous investigations were conducted dealing with the distribution and seasonal occurrence of zoosporic fungi in various water areas (e.g. El-Hissy, 1974; El-Hissy, et al., 1982 and El-Hissy and Khalil, 1989), up till now, the seasonal occurrence and distribution of the so-called aquatic *Hyphomycetes* untouched. Thus, this investigation aimed mainly to bridge this gap.

MATERIALS AND METHODS

From both sides of the river Nile at Sohag city (500 Km south Cairo), surface water and submerged decaying leaves samples were collected monthly during the period from July, 1989 to December, 1990 (18 months).

The water samples were collected and treated as previously described by Khalil (1984) for the recovery of zoosporic fungi. The seed plates were incubated at 22°C for 4 to 6

weeks during which the zoosporic fungi which colonized the seeds were examined weekly. For the determination of fungal density (counts), the fungal species appearing on one plate was counted as one colony.

The submerged decaying leaves of the five common plants on the Nile banks (*Phoenix dactylifera*, *Phragmites australis*, *Eichhornia crassipes*, *Musa nana* and *Eucalyptus rostrata*) were best gathered individually and placed at once in clean plastic bags and returned to the laboratory (Iqbal and Webster, 1973 a,b). The leaves were washed under tap water to remove any surface mud or other debris, then they were cut into equal segments (about one square centimeter each) and put into shallow dishes (10 plates for each sample and 5 leaf segments for each plate) containing sterilized distilled water. These plates were examined after a few days for *Hyphomycetes*. Growth of aquatic *Hyphomycetes* can usually be seen specially on the cutting edges of the leaf margins and on exposed veins in areas where decay is occurring. When a growth of a particular species has been located, a small portion of the leaf bearing growth can be cut out and used to make a water mould that can be studied under high power (Ingold, 1975). To isolate a species in a pure culture, a piece of leaf bearing abundant conidiophores can be placed in few drops of sterilized water in a covered watch glass. In the course of half a day conidial suspension will probably be developed in the water (this can be checked under low power). Single spores were isolated and streaked on 1% malt extract agar at 20°C (Ingold, 1975). The pure cultures were maintained on slopes of 2% malt extract agar and stored at 5-10°C and sub-cultured every 1-2 months.

Some water characteristics such as temperature, pH value, total soluble salts, contents of organic matter and dissolved oxygen were determined in monthly collected water samples.

RESULTS AND DISCUSSION

During the experimental period the temperature of water samples ranged between 16.0° and 32.5°C, the pH value between 6.7 and 8.2, the total soluble salts between 425.0 and 701.0 mg/l, the contents of organic matter between 96.0 and 166.0 mg/l and the dissolved oxygen fluctuated from 3.8 to 9.5 mg/l.

Fifty-eight species which belong to 26 fungal genera contributing 1709 colonies were recovered from surface water samples (zoosporic fungi) and from submerged decaying leaves of five common plants (aquatic *Hyphomycetes*) during this investigation (Tables 1, 2).

It is more convenient to exhibit each of the two groups of fungi separately:

A. ZOOSPORIC FUNGI –PERENOSPORALES AND SAPROLEGNIALES

Thirty-two species related to seven zoosporic fungal genera yielding 671 colonies were recovered from surface water samples collected monthly from the river Nile at Sohag city during the period from July 1989 to December 1990 (Table, 1) using baiting technique (Khallil, 1984). One species (*Isoachlya toruloides*) is new record to Egypt.

The richest samples with zoosporic fungi were those collected in February (9 species, 4 genera, 9.24% of total count of zoosporic fungi), April (9 species, 5 genera, 8.35% of total zoosporic fungi) and October (9 species, 6 genera, 5.37% of total zoosporic fungi) 1990. On the other side, the samples collected in August (1989, 1990) were the poorest and contributed 2-3 species only (2.53% of total count of zoosporic fungi each).

Thus, the winter months which are characterized by low or moderate temperature (15-23°C) contributed the broadest spectrum of species and high fungal population. Similar results were obtained by many authors studying the seasonal periodicity of zoosporic fungi (e.g. Forbes 1935 a,b; Perrot, 1960; Ismail et al. 1979; El-Hissy et al. 1982; Misra 1982; and El-Hissy and Khallil, 1989). However, Klick and Tiffany (1985) reported that although the temperature is important in seasonal periodicity of saprolegniaceous fungi, is not the only factor influencing their occurrence. Some other observations recorded somewhat inconsistent results (e.g. Srivastava 1967; Okane, 1978; Cooke, 1954; Rooney and McKnight 1972). This inconsistency could be due to the difference in temperature of the various geographical regions subjected to investigation. Also, the richest samples in zoosporic fungi were almost having a relatively high content of organic matter and dissolved oxygen. Similar results obtained by Cooke and Bartsch (1959) who reported that the variability in the distribution of zoosporic fungal species in different water samples and habitats may be due to the variations in their physico-chemical nature. Misra (1982) pointed out the presence of organic debris is one of the probable reasons for the frequent and higher collections of zoosporic fungi from ponds having vegetation and hence organic matter. Roberts (1963), Khallil (1984) and El-Hissy and Khallil (1989) reported similar results. Also, Lund (1934); Suzuki (1961, 1962); Dayal and Tandon (1963); Misra (1982) and El-Hissy and Khallil (1989) found a close relationship between the dissolved oxygen of water samples and the occurrence, seasonal changes and zoosporic production of aquatic fungi. On the other side, Alabi (1971) and Rattan et al. (1980) reported that no clear relationship could be established between the occur-

rence of zoosporic fungi and the fluctuations in the amount of dissolved oxygen.

The contents of total soluble salts (425.0-701.0 mg/l) and the pH value (6.7-8.2) in this investigation exhibited a narrow range and did not display any regular pattern in various months. This means that (at least in this study), the contents of total soluble salts and the pH value did not play a major factor governing the monthly fluctuations of zoosporic fungi. In this respect, Te Strake (1980) mentioned that salinity is the primary factor accounting for presently observed distribution patterns of *Saprolegniaceae* and the species of *Saprolegniaceae* are limited in their occurrence in estuaries (comparatively high salinity). Höhnk (1935, 1939) mentioned that water moulds are not recoverable from estuarine regions exceeding about 7 ppt salinity. Te Strake (1959) noted that the highest salinity in which water moulds occurred was 0.28‰ and the ecological distributional pattern of some *Saprolegniaceae* appears to be limited by salinity. Recently, El-Hissy and Khallil (1989) mentioned that no Saprolegniaceous fungi were recovered from water sites having salinity exceeding 1.5‰. However, some aquatic fungal species specially those belonging to *Perenosporales* and to *Chytridiales* appeared with limited populations in estuarine sites having comparatively high salinity.

As regards the pH value, our results are in accordance with those obtained by Dick and Newby (1961), Al-Saadi et al. (1979), El-Hissy et al. (1982), El-Hissy and Khallil (1989), El-Hissy and Abd-Eluah (1989), Paul et al. (1984) and Khallil (1984). However, Lund (1934) found that a number of fungi were specific for highly acidic waters, some being fairly common and some quite rare. Roberts (1963) found the largest number of water moulds in water having pH 5.6-7.4 (neutral). Suzuki (1960) observed that acidic waters contain less water moulds. Srivastava (1967) mentioned that the pH values of water may not be the only factor determining the distribution of aquatic fungi. Dayal and Tandon (1963) observed a maximum number of water moulds from a pond having pH 6.9-7.0. Khulbe (1980) classified aquatic species into three groups; fungi with wide range of pH tolerance (7.3-8.8), fungi with moderate range (7.4-8.2) and fungi with narrow range of pH tolerance (7.3-7.7).

Achlya (10 species), *Dictyuchus* (3 species), *Pythium* (5 species) and *Saprolegnia* (8 species) were of high occurrence and was represented in 100%, 94.44%, 55.56%, 50.00%, of total samples matching 42.32%, 26.97%, 6.86% and 14.00% of total zoosporic fungi, respectively. *Allomyces* (2 species), *Isoachlya* (3 species) and *Phytophthora* (one species) were of moderate, low or rare occurrence (16.67-44.44% of total samples) constituting 1.79-4.47% of total counts. This was not unexpected as *Achlya* and *Saprolegnia* are large genera containing species known to be common in aquatic habitats (Lui and Volz, 1976). These results are in accordance with those obtained by many authors (e.g. Rattan et al., 1980; El-Hissy et al., 1982; Klick and Tiffany, 1985 and El-Hissy and Khallil, 1989).

Dictyuchus sterile and *Achlya racemosa* were the most prevalent species and emerged from 94.44%, 88.89% of total samples matching 23.70% and 24.44% of total counts, respectively.

The richest months with *Achlya* were March (4 species; 11.62% of total *Achlya*), February (4 species; 9.86% of total *Achlya*) 1990 and October 1989 (3 species, 10.21% of total *Achlya*). The poorest months were August 1989 and 1990 (one species each) constituting 0.70% and 1.41% of total *Achlya*, respectively. Some species of *Achlya* were isolated

TABLE 1: Monthly variations of zoosporic fungi recovered from water samples collected from the river Nile at Sohag during the period from July 1989 to December 1990 using baiting technique at 22°C.

Years		1989						1990												Total			
Species	Months	VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	TC	NCI	%TC	%NCI
<i>Achlya</i>		8	2	14	29	26	13	17	28	33	15	16	11	11	4	14	14	13	16	284	18	42.32	100
<i>A. americana</i> Humphrey		0	0	0	3	9	0	0	0	0	0	0	0	0	0	0	4	0	0	16	3	2.38	16.67
<i>A. apiculata</i> de Bary		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	7	1	1.04	5.56
<i>A. caroliniana</i> Coker		6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1	0.89	5.56
<i>A. colorata</i> Pringsheim		0	0	0	0	0	0	0	3	9	0	0	0	0	0	0	0	0	0	12	2	1.79	11.11
<i>A. conspicua</i> Coker		0	0	3	0	0	2	2	8	3	0	7	0	0	0	0	0	0	3	28	7	4.17	38.89
<i>A. dubia</i> Coker		0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	6	2	0.89	11.11
<i>A. imperfecta</i> Minden		2	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	2	1.34	11.11
<i>A. klebsiana</i> Pieters		0	0	0	5	0	0	0	0	0	0	0	6	5	0	14	3	0	0	33	5	4.92	27.28
<i>A. prolifera</i> Nees		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	1	0.60	5.56
<i>A. racemosa</i> Hildebrand		0	2	4	21	17	11	15	12	20	15	9	5	6	4	0	7	6	9	163	16	24.44	88.89
<i>Allomyces</i>		0	0	2	6	5	1	3	0	0	0	0	0	0	0	0	3	0	4	24	7	3.58	38.89
<i>A. arbuscula</i> Butler		0	0	2	6	5	0	3	0	0	0	0	0	0	0	0	3	0	0	19	5	2.83	27.78
<i>A. macrogynus</i> (Emerson) Emerson and Wilson		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	5	2	0.75	11.11
<i>Dictyuchus</i>		17	15	13	10	0	12	7	14	9	15	10	7	10	11	8	8	4	11	181	17	26.97	94.44
<i>D. monosporus</i> Leitgeb		0	0	0	0	0	3	0	0	2	6	0	0	0	0	0	0	0	8	19	4	2.83	22.22
<i>D. polysporus</i> Lendstedt		0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	3	2	0.45	11.11
<i>D. sterile</i> Coker		17	15	13	10	0	9	7	12	6	9	10	7	10	11	8	8	4	3	159	17	23.70	94.44
<i>Isoachlya</i>		5	0	0	0	4	0	5	0	0	0	0	0	4	0	2	5	3	2	30	8	4.47	44.44
<i>I. monilifera</i> (de Bary) Kauffmann,		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	3	0	8	2	1.19	11.11
<i>I. toruloides</i> Kauffman and Coker		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	0.30	5.56
<i>I. unispora</i> Coker		5	0	0	0	4	0	5	0	0	0	0	0	4	0	2	0	0	0	20	5	2.98	27.78
<i>Phytophthora cinchonae</i> Sawada		0	0	0	0	0	0	0	0	0	7	0	0	3	0	2	0	0	0	12	3	1.79	16.67
<i>Pythium</i>		3	0	0	2	3	0	0	3	0	7	9	0	9	2	0	3	5	0	46	10	6.86	55.56
<i>P. butleri</i> Subram		0	0	0	0	0	0	0	3	0	0	0	0	9	0	0	0	0	0	12	2	1.79	11.11
<i>P. indicum</i> Merus		0	0	0	0	3	0	0	0	0	0	9	0	0	0	0	0	0	0	12	2	1.79	11.11
<i>P. ostracodes</i> Drechsler		0	0	0	2	0	0	0	0	0	3	0	0	0	2	0	0	0	0	7	3	1.04	16.67
<i>P. salpingophorum</i> Drechsler		3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	7	2	1.04	11.11
<i>P. ultimum</i> Trow		0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	3	1	0	8	3	1.19	16.67
<i>Saprolegnia</i>		0	0	0	0	9	27	8	17	5	12	0	0	0	0	0	3	4	9	94	9	14.00	50.00
<i>S. anisospora</i> de Bary		0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	5	1	0.75	5.56
<i>S. diclina</i> Humphrey		0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	12	1	1.79	5.56
<i>S. eccentrica</i> (Coker) Seymour		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	9	1	1.34	5.56
<i>S. ferax</i> (Gruith) Thuret		0	0	0	0	9	5	8	0	0	6	0	0	0	0	0	2	0	0	30	5	4.47	27.78
<i>S. hypogyna</i> de Bary		0	0	0	0	0	13	0	0	0	5	0	0	0	0	0	0	0	0	18	2	2.68	11.11
<i>S. megasperma</i> Coker		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	5	2	0.75	11.11
<i>S. monoica</i> Pringsheim		0	0	0	0	0	9	0	5	0	0	0	0	0	0	0	0	0	0	14	2	2.09	11.11
<i>S. parasitica</i> Coker		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0.15	5.56
Total counts		33	17	29	47	47	53	40	62	47	56	35	18	37	17	26	36	29	42	671			
Total species		5	2	5	6	6	3	6	9	8	9	4	3	6	3	4	9	7	8	32			
Total genera		4	2	3	4	5	4	3	4	4	5	3	2	5	3	4	6	5	5	7			

only in summer months (high temperature) and missed in winter months (Table 1) and vice versa. Consistent results were obtained by Hughes (1962) and Fox and Wolf (1977) and others.

The richest months in *Dictyuchus* were March (3 species; 4.97% of total *Dictyuchus*), April (2 species; 8.29% of *Dictyuchus*) 1990 whereas November 1989 (no species) and 1990 (one species) were the poorest matching 0.0% and 2.2% of total *Dictyuchus* respectively. *D. sterile* was the most common species whereas *D. polysporus* was of rare occurrence (11.11% of total samples and 11.05% of total *Dictyuchus* count).

Pythium was represented by 5 species from which *P. ultimum* and *P. ostracodes* were the most prevalent species (3 samples each) constituting 17.39% and 15.22% of total *Pythium* respectively.

Saprolegnia contributed 8 species (25.0% of total species) from which *S. ferax* was the commonest species (27.78% of total samples and 31.91% of total *Saprolegnia*). *Saprolegnia* species were recovered only in months having low/moderate temperature and completely disappeared in summer months (high temperature).

The remaining species (Table 1) were of moderate, low or rare occurrence. Similar results were obtained in various water habitats in different countries (e.g. Hughes, 1962; Roberts, 1963; Fox and Wolf, 1977; Rattan et al., 1980 and others) and in Egypt (e.g. El-Hissy et al., 1982, El-Hissy and Abd-Elaah, 1989 and El-Hissy and Khalil, 1989).

B. AQUATIC HYPHOMYCETES

Twenty-six species which belong to 19 genera (1038 colonies) of aquatic hyphomyceteous fungi were recovered from submerged decaying leaves of five plants (*Phoenix dactylifera*, *Phragmites australis*, *Eichhornia crassipes*, *Musa nana* and *Eucalyptus rostrata*) collected monthly from various water localities in river Nile at Sohag during the period from July 1989 to December 1990 (Table 2). Three species (*Exophiala jeanselmei*, *Flabelliospora* species and *Varicosporium delicatum*) are new records to Egypt. The richest months in aquatic hyphomycetes populations were November 1989, January and March 1990 contributing 9.92%, 9.25% and 8.96% of total counts, respectively. The broadest spectrum of species were recorded in samples collected in November 1989 (14 species; 10 genera) and in October 1990 (13 species, 10 genera). On the other side the poorest month with aquatic conidial fungi was August 1989 (0.67% of total counts, 3 species, 3 genera). It was observed that the highest fungal populations were recorded in samples collected in months which are characterized by comparatively low temperatures and the summer months (high temperature) were the poorest. This is in accordance with the results obtained in case of zoosporic fungi. Ingold (1975) mentioned that these fungi reach their richest development in the last three or four months of the year. Iqbal and Webster (1973 b, 1977) in England, reported that most of aquatic hyphomycetes showed high sporulation during autumn, winter and spring with almost no conidial production during the summer months. Müller-Häeckel and Marvanova (1979) found that two maxima of aquatic hyphomycetes; a main one in autumn and a smaller one in spring. Michaelides and Kendrick (1978) reported that the concentration of conidia are high throughout the year except in the period May-July. Willoughby and Archer (1973) found that *Hyphomycetes* conidia were more abundant during

the wet period (September to November) than during the dry period (May to June).

It was found that the submerged decaying leaves which were collected from the water sites having relatively high contents of dissolved oxygen and organic matter were the richest in aquatic *Hyphomycetes*. Sporulation of aquatic *Hyphomycetes* in relation to aeration is an important phenomenon when studied in the field as well as in the laboratory. In this respect, in the field, Ingold (1952, 1961, 1966, 1967) observed that foam is an effective trap for aquatic *Hyphomycetes* and if foam from a well aerated stream is collected, it contained a dense accumulation of spores. Iqbal and Webster (1973a) observed the effectiveness of trapping of aquatic *Hyphomycetes* by air bubbles. In general, the branched types of spores (e.g. *Alatospora acuminata*) are more affected by aeration than the sigmoid spores (e.g. *Anguillospora crassa*). Moreover, Webster and Towfik (1972) have shown that increasing the rate of aeration from 100 ml/min to 1000 ml/min resulted in an increased spores production. Similar observations were reported by Webster (1959).

As in case of zoosporic fungi in this investigation, no regular considerable influence of total soluble salts and pH value of water sites on the populations of aquatic *Hyphomycetes* was found. Unfortunately, there is no available literature concerning the relation of the contents of organic matter, total soluble salts and pH value and the fungal populations of aquatic *Hyphomycetes* in the fields.

Alatospora acuminata, *Triscelophorus monosporus*, *Triscelophorus* sp., *Anguillospora longissima* and *Pyramidospora casuarina* were the most common species and were represented in 94.44, 88.89, 77.77, 72.22 and 72.22% of total samples matching 13.78, 39.21, 5.97, 8.38 and 5.88% of total counts, respectively. Padgett (1976) and Ingold (1979) concluded that *Triscelophorus monosporus*, *Campylospora chaetoclada* and *Lunulospora curvula* tend to dominate the submerged leaf flora in tropical conditions. The highest counts of *Alatospora acuminata* were recorded in February and March, 1990 (1.64% and 1.74% of total counts, respectively) and the lowest counts were in August (one colony) and September (no colonies) 1989. Müller-Häeckel and Marvanova (1979) mentioned that *Alatospora acuminata* tolerate best the low water temperature during the winter whereas *Lemonniera aquatica* seemed to be the most sensitive species to higher water temperatures during late spring and summer. *Triscelophorus* (2 species) recorded the highest populations in November 1989 and March 1990 matching 5.30% and 4.24% of total fungi, respectively. In general some species recorded the highest populations in warmer months (summer) and other species (Table, 2) in colder months (winter). Moreover, some species were recovered in one month only (e.g. *Articulospora tetracladia* in January, 1990; *Campylospora chaetoclada* and *C. parvula* in November, 1990; *Exophiala jeanselmei* in April 1990; *Flabelliospora* species in November 1989 and *Varicosporium delicatum* in September 1990). Iqbal and Webster (1973b) reported that *Tricladium chaetocladium* was largely restricted to winter (December to March) while *Lunulospora curvula* and *Triscelophorus monosporus* (Ingold, 1975) occurred from August to October but was absent in winter. In this investigation, *Lunulospora curvula* was isolated in all months except in July, August, December, 1989; July and September 1990.

Iqbal et al. (1980); Baerlocher (1982) and Chamier and Dixon (1982) made a framework of seasonal variations and found that numbers of conidia of different species may vary

TABLE 2: Monthly variations of aquatic Hyphomycetes recovered from samples of submerged decaying leaves collected from the river Nile at Sohag during the period from July 1989 to December 1990.

Years		1989						1990												Total			
Species	Months	VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	TC	NCI	%TC	%NCI
<i>Alatospora acuminata</i> Ingold		3	1	0	7	2	5	7	17	18	8	12	3	8	6	14	12	7	13	143	17	13.78	94.44
<i>Anguillospora longissima</i> (de Wild) Ingold		0	0	5	10	3	7	11	7	0	8	0	3	2	0	5	7	7	12	87	13	8.38	72.22
<i>Articulospora tetraccladia</i>		0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3	1	0.29	5.56
<i>Campylospora</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	1	0.29	5.56
<i>C. chaetocladia</i> Ransoni		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0.10	5.56
<i>C. paravula</i> Kuzuha		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1	0.19	5.56
<i>Centrospora acerina</i> (Hartig) Newhall		0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	3	3	0.29	16.67
<i>Clavatospora tentacula</i> (Umphlett) Nilsson		0	0	0	0	2	0	3	0	0	0	0	0	0	0	0	2	0	0	7	3	0.67	16.67
<i>Dactylella submersa</i> (Ingold) Nilsson		7	0	5	3	5	5	4	5	4	3	0	0	2	2	3	0	0	0	48	12	4.62	66.67
<i>Exophiala jeanselmei</i> Mc Ginnis & Padhye		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0.10	5.56
<i>Flabellospora</i>		0	0	0	1	7	4	0	0	4	0	6	0	0	0	5	3	2	2	45	9	3.28	50.00
<i>F. crassa</i> Alasoadura		0	0	0	1	6	4	0	0	4	0	6	0	0	0	4	2	2	2	31	9	2.99	50.00
<i>F. tetraccladia</i> Nawawi		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0.10	5.56
<i>Flabellospora</i> sp.		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	2	2	0.19	11.11
<i>Flagellospora</i>		2	4	9	0	3	3	3	2	1	0	0	0	0	0	1	3	14	5	50	12	4.82	66.67
<i>F. curvula</i> Ingold		0	0	0	0	1	2	0	0	0	0	0	0	0	0	1	3	2	3	12	6	1.16	33.33
<i>F. penicilloides</i> Ingold		2	4	9	0	2	1	3	2	1	0	0	0	0	0	0	0	12	2	38	10	3.66	55.56
<i>Heliscus submersus</i> Hudson		0	0	0	0	0	4	3	2	0	0	0	0	0	0	0	0	0	0	9	3	0.87	16.67
<i>Isthmotricladia laeensis</i> Matsushima		0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2	2	0.19	11.11
<i>Lemonniera</i>		0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3	0	2	7	3	0.67	16.67
<i>L. aquatica</i> de Wild		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	2	5	3	0.48	16.67
<i>L. terrestris</i> Tubaki		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2	2	0.19	11.11
<i>Lunulospora curvula</i> Ingold		0	0	9	0	5	0	10	7	10	5	4	3	0	2	2	4	3	0	64	12	6.17	66.67
<i>Pyramidospora</i>		0	2	5	9	13	8	0	6	2	0	4	3	0	4	0	3	2	3	64	13	6.17	72.22
<i>P. casuarina</i> Nilsson		0	2	5	9	12	7	0	5	2	0	4	3	0	4	0	3	2	3	61	13	5.88	72.22
<i>P. constricta</i> Singh		0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	3	3	0.29	16.67
<i>Tetraccladium marchalionum</i> de Wild		0	0	0	4	8	14	12	9	10	2	0	0	0	4	0	6	18	14	101	11	9.73	61.11
<i>Torula herbarum</i> Pers		0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	3	2	0.29	11.11
<i>Triscelophorus</i>		3	0	32	28	55	23	39	32	44	17	26	9	0	8	15	27	26	23	407	16	39.21	88.89
<i>T. monosporus</i> Ingold		3	0	32	24	48	21	30	30	30	15	24	5	0	7	11	25	20	20	345	16	33.24	88.89
<i>Triscelophorus</i> sp.		0	0	0	4	7	2	9	2	14	2	2	4	0	1	4	2	6	3	62	14	5.97	77.77
<i>Varicosporium delicatum</i> Crane		0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	1	0.19	5.56
Total counts		15	7	65	63	103	74	96	89	93	44	53	21	14	27	48	70	82	74	1038			
Total species		4	3	6	9	14	12	11	12	9	8	7	6	4	8	11	13	12	10	26			
Total genera		4	3	6	8	10	10	11	10	8	7	6	5	4	7	9	10	9	8	19			

seasonally in ways: the number of conidia of some species reaches its peak in the autumn (*Flagellospora curvula*), others in winter (*Tricladium chaetocladium*) and still others in the summer (*Lunulospora curvula*). The effects of temperature on growth and sporulation of *Tricladium chaetocladium* and *Lunulospora curvula* were also studied (Webster et al., 1976). They found that the optimum temperature for growth and sporulation for *L. curvula* are some 5°C higher than for *T. chaetocladium* (20°C). The better performance of *L. curvula* at higher temperature may be reflected in its world-wide distribution.

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ZMIENNOŚĆ SEZONOWA OOMYCETES ORAZ WODNYCH HYPHOMYCETES W SOHAG (GÓRNY EGIPT)

STRESZCZENIE

W trakcie eksperymentu (18 miesięcy) stwierdzono obecność 58 gatunków grzybów należących do 26 rodzajów *Perenosporales* i *Saprolegniales* oraz wodnych *Hyphomycetes* (zbieranych z powierzchni wody i zanurzonych, rozkładających się liści). Każdego miesiąca pobierano 10 prób grzybów. Najwięcej wszystkich badanych grzybów zawierały próbki z miejsc charakteryzujących się niską lub umiarkowaną temperaturą, dużą zawartością substancji organicznej i dużą zawartością tlenu. Wartość pH i zawartość substancji mineralnych nie wykazywały zmienności miesięcznej i nie wpływały na populacje grzybów. Dominującymi gatunkami były *Achlya racemosa*, *Dictyuchus sterile* (*Saprolegniales*) oraz *Alatospora acuminata* i *Trisclophorus monosporus* (wodne *Hyphomycetes*). Niektóre grzyby wykazały nasilenie pojawów zimą, inne w miesiącach letnich, niektóre pojawiały się w ciągu całego roku. Jeden gatunek z *Saprolegniales* (*Isoachlya toruloides*) i trzy należące do wodnych *Hyphomycetes* (*Exophiala jeanselmei*, *Flabellospora* sp. i *Varicosporium delicatum*) są nowymi dla mikoflory Egiptu.

SŁOWA KLUCZOWE: grzyby wodne, Górny Egipt