Mycology

DISTRIBUTION AND SEASONAL OCCURRENCE OF AQUATIC PHYCOMYCETES IN WATER AND SUBMERGED MUD IN EL-IBRAHIMIA CANAL (UPPER EGYPT)

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SUMMARY: From 33 tested grains and seeds, sesame, hemp seeds, barley and maize grains proved to be best baits for aquatic phycomycetes in El-Ibrahimia Canal. The richest periods in aquatic fungi were of low or moderate temperature months and the poorest were summer months. Organic matter contents of water and mud samples showed its highest values in winter months where pH values did not perform any regular seasonal variation. Achlya was the most prevalent genus in water samples (23 months) while Dictyuchus and Pythium were the most common genera in submerged mud (each 24 months) Apodachlya, Ganopodya, Calyptralegnia, Leptomitus and Woronina emerged from water samples only while Aqualindrella, Blastocladia, Blastocladiella, Leptolegnia and Nowakowskia emerged from submerged mud. Achlya dubia, A. proliferoides, A. debaryana, A. carolinina, A. polyandra, A. combrica, A. oligacantha, A. apiculata, A. hypoyna, A. radiosa, Sap-rolegnia megasperma, S. anisospora, E. parasitica, S. diclina, S. furcata, S. trufosa, S. uliginosa, S. litoralis, Allomyces javanicus, Isoachlya monilifera, I. eccentrica and Pilobolus kelinii emerged from surface water only. On other side, Pythium echinulatum, P. intermeduim, Phytophthora cinchonae, Brevilegnia unisperma var. Delica, Isoachlya unispora and Pilobolus nanus emerged from submerged mud. Saprolegnia disappeared completely during summer months in both surface water and submerged mud samples.

Key Words: Phycomycetes, achlya, phythium.

INTRODUCTION

The distribution and seasonal fluctuations of aquatic zoosporic fungi in relation to environmental conditions as well as to the various geographical regions of the world have been intensively investigated by many authors, e.g. Lund (36) in Denmark, Johnson (28) in Scandinavia, Forbes (21), Waterhouse (51, 52), Perrot (42) and Willo-ughby *et al.* (55) in the United Kingdom, Johnson *et al.* (27) in ICE Land, Jacobson (25) in Germany, Zebrowska (58) in Poland, Coker (6), and Klick and Tiffany (33) in the USA, Nolan (41) in Canada, Karling (29) and Milanez (37, 38) in Brazil, Carronco *et al.* (4) in Mexico, Rossy (46) in Puerto Rico, Karling (30) and Elliot (15) in New Zealand, Youatt (56) in Australia, Knox and Peterson (34) in Antarctica, Naumov (40) in the Soviet Union, Okena (1978) in Japan, Chein (5) in Taiwane, Yung and Stenton (57) in Hong Kong, Chaudri *et al.* (1947), Dayal and Tandon (7) and Misra (39) in India, Rattan *et al.* (19) in Nigeria and El-Hissy (8-11), El-Hissy *et al.* (13), El-Hissy and El-Nagdy (12), El-Nagdy (16-17), Abd-Ellah (1) and El-Hissy and Khallil (14), in Egypt.

MATERIALS AND METHODS

Ibrahimia canal is the biggest irrigation canal in Egypt. It arises from the River Nile at Assiut and extends to about 360 kilometers up to El-Giza. Its width is about 160 meters which decreases as the canal extends and the water depth is about 6 meters which also decreases as the canal extends.

A preliminary experiment was conducted to choose the best baiting substances for the recovery of aquatic fungi. Thirty-three grains and seeds were tested as baits. These were, *Hordeum vulgare, Oryza sativa, Sorghum virigatum, Sporobolus airoides, Triticum vulgare, Zea mays, Asphodelus sp., Pancratium sp., Cicer arietinum, Lupinus termis, Lens esculenta, Lagonchychium sp., Phaseolus vulgaris, Trifolium alexandrium, Vicia faba, Ceratonia sliqua, Capsicum sp., Hyposcyamus muticus, Eruca sativa, Raphanus sativus, Pimpinella anisum, Citrus sinensis, Sesame indicum, Nigella sativa, Arthrocnemon glaucum, Ricinus communis, Calitrops sp., Zygophyllum album, Cannabis sativa, Hibiscus esculentus, Gossypium barbadense, Carthamus tinctorius* and *Hellianthus annus.*

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Surface water samples were collected monthly during the period from December 1981 to November 1983 and brought directly to the laboratory in sterile clean conical flasks. The organic matter content and total soluble salts of the water samples were determined. PH values and temperature were also recorded. For the recovery of aquatic fungi from the collected water samples, aliquots of canal water (about 150 ml each) were introduced in 16 sterile Petri-dishes (15 cm in Diameter). Halves of sterilized hemp., sesame seeds and barley, maize grains, which proved to be the best baits, were introduced into the above to be the best baits, were introduced into the above treated Petri-dishes (4 plates for each bait). These dishes were then left overnight at room temperature. Then the colonized baits were transferred into sterile Petri-dishes containing sterile filtered canal water to which crystalline penicillin (2000 units/liter; Roberts 1963) was added, to depress bacterial growth. The dishes were then incubated at 22±2°C for 4-6 weeks during which the dishes were weekly examined. The recovered aquatic fungi were purified on glucose-peptone (Gp) agar medium (54).

During the same period and from the same site where the water samples were collected monthly, submerged mud were also collected in clean plastic bags and were immediately brought to the laboratory, from which the aquatic fungi were recovered:

50 gm of mud were introduced in a sterile 2 L conical flask and were raised to 1500 ml by adding sterile distilled water. Technical flask was then shaken gently for about 5 minutes. Ten Petri-dishes (15 cm in diameter) were plated each with 100 ml of the supernatant mud wash water. Sterilized baits (sesame-, hemp seeds and barley-, maize grains) were introduced into dishes which were then treated exactly as described before to isolate and identify aquatic phycomycetes. The purified aquatic fungal genera and species were identified according to the following references (6, 20, 26, 31, 44, 47-49, 51, 52, 59).

RESULTS AND DISCUSSION

Water samples

The results in Table 1 show that the richest periods in aquatic fungal genera and species were December 1981-April 1982, November-December 1982, January-April 1983 and October-November 1983. These periods represent low or moderate temperature months (14-20°C). The poorest periods were from May-September (1982, 1983) which are almost summer months with relatively high temperature (21-27°C). These results are in accordance with those obtained by many investigators, Forbes (21, 22) studied the aquatic fungi in many ponds in the United Kingdom, reported a marked periodic variation in abundance. This variation generally consists of a gradual increase in the number of records up to a maximum abundance, sometimes during the winter, and then a corresponding decrease until the species may apparently disappear altogether in the summer. Dayal and Tandon (7), Roberts (1963), El-Nagdy (16), El-Hissy *et al.* (13), Misra (39) and Khallil (32), reported that the low or moderate temperature periods are favorable for aquatic fungal population.

Fifty-two species which belong to twenty genera were collected during this experiment. The genera namely, *Achlya, Dictyuchus, Pythium* and *Saprolegnia* were of high frequency of occurrence and emerged in 23, 23, 23 and 15 out of 24 months respectively. *Phytophthora* and *Pythiopsis* were of moderate occurrence (9 and 6 months) respectively. The remaining genera were of low or rare occurrence (1-5 months).

Achlya was the leading organism and contributed the broadest spectrum of species (12 identified species) in addition to an unidentified species. The richest months in addition to an unidentified species. The richest months in *Achlya* species were June, 1982, June, August and November 1983 yielding 3 species each in addition to unidentified one. The unidentified species, *A. racemora, A. dubia, A. proliferoides* and *A. debaryana* were the most common species and emerged in (19, 7, 5, 5 and 4 months) respectively. This result was in agreement with that obtained by Chauduri *et al.* (1947) in India, who reported that *Achlya* was the most common genus throughout the year. Klick and Tiffany (33) reported that occurrence of *Achlya* showed its peak not only in the spring and fall but also a third peak in mid-summer. Generally, in the present work, it was observed that centric or sub-centric oospore species of *Achlya* predominated in low or moderate temperature months and those with eccentric oospores were prevalent in relatively higher temperature months. Similar results were obtained by Forbes (21, 22), and Rattan *et al.* (44).

Dictyuchus was also of high occurrence (23 months) and contributed five species. The richest months in *Dictyuchus* were February and March, 1982, 1983 (4 species each). Rattan *et al.* (44) in Iraq, mentioned that the species of *Dictyuchus* occur throughout the year but seem to grow best at moderate temperature (19-27°C) in spring and autumn. Misra (39) in India, found that *Dictyuchus* species predominated only in winter months.

Pythium was represented by *P. undulatum, P. thallasium* and unidentified species, which emerging in (5, 2 and 23 months) respectively. This is in accordance with the results obtained by Höhnk and Bock (23) and Waterhouse (50) who reported that *Pythium* has appeared nearly in all months. Moreover, El-Nagdy (16,17), El-Hissy *et al.* (13) and Khallil (32) reported that *Pythium* did not show any regular seasonal trend. On the other hand, El-Sharouny (18) working on *Pythium* in Egyptian soils, reported that *Pythium* was recovered in relatively high counts in cold months and was almost absent in summer months.

Table 1: Monthly records of aquatic phycomycetes recovered from surface water (W) and submerged mud (M) samples collected from El-Ibrahimia Canal during the period from December 1981 to November 1983.

Years	1981		1982																								1983																					
Months	Dec		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov	
Species	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m
Achlya	+	-	+	+	+	+	+	+	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	+	+	+	+	-	-	+	+	-	+	-	+	+	+	-	+	-	+	+	+	+	+	+
A. apiculata de Bary	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. cambrica Johnson	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
A. caruliniana Coker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-
A. debaryana Humphery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
A. dubia Coker	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-
A. hypogyna Coker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. oligacantha de Bary	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
A. polyandra Hildebrand	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-
A. proliferoides Coker	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	+	-	-	-	+	-
A. racemous Hildebrand	-	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-
A. radiusa Maurizio	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Achlya species	+	-	+	+	-	+	-	+	+	-	+	-	+	-	+	-	+	-	+	-	-	-	+	-	+	-	+	-	+	-	-	+	+	-	-	-	+	+	+	-	+	-	+	+	+	-	+	+
Dictyuchus	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
D. carpophorus Zopf.	+	+	+	-	-	+	-	+	-	-	-	-	-	+	-	-	-	-	-	+	-	+	+	-	-	+	+	-	+	-	+	+	-	-	-	-	-	+	-	+	+	-	-	+	-	+	+	-
D. magnusii Lindst	-	-	-	-	+	+	+	+	+	+	+	-	-	-	-	-	-	-	+	+	-	+	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
D. monosporus Leitgeb	+	-	+	-	+	+	+	+	-	-	+	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	+	-	+	-	+	-	+	+	-	-	-	-	-	-	+	+	-	-	-	-	-	-
D. polysporu Lendst	-	-	-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
D. sterile Coker	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Saprolegnia	+	-	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	+	-	+	+	+	+	+	+	+	-	+	+	+	-	+	-	-	-	-	-	+	-	-	-	+	+	+	+
S. anisospora de Bary	-	-	+	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. diclina Humphrey	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. ferax (Gruith) Thuret	-	-	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	+	-	+	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	+	+
S. furcata Maurizio	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. hypogyna de Bary	-	-	-	+	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	+	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-
S. littoralis Coker	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. megasperma Coker	+	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. parasitica Coker	-	-	+	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. turfusa Minden	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. uliginosa Johannes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saprolegnia species	+	-	+	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	+	-	+	-	+	-	+	-	+	-	-	-	-	-	-	-	-	-	+	+	-	+
Brevilegnia	-	-	-	+	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	+
B. unisperma Coker	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	+
B. unisperma var. delica Co.	-	-	-	+	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brevilegnia species	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calyptralegnia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. achlyoides Coker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isoachlya	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	+	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I. eccentrica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I. monilifera Coker	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I. unispora Coker	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leptolegnia	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
L. caudata de Bary	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
L. eccentrica Coker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pythiopsis	-	-	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+
P. cymosa de Bary	-	-	-	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
P. humphreyana Coker	-	-	+	+	-	+	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pythiopsis species	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Transtotheca	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	+	+	+	-	+	+	-	-	-	+
T. clavata Humphrey	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	+	+	-	+	+	-	-	-	+
Thranstotheca species	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Aqualinderella	-	+	-	+	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
A. fermentans Em.&We.	-	+	-	+	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Leptomitus	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. lacteus Agardh	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 1: Continued.

Years	1981	1982																								1983																					
Months	Dec	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov	
Species	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m	w	m
Abodachlya	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
A. brachynema Co.&Ma.	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Woronina polycystis	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
in Saprolegnia Cornu	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Olpidiopsis	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. achlyae Mclarthy	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phytophthora	-	+	+	+	+	+	-	+	-	-	-	-	+	-	+	-	-	+	-	-	-	+	-	+	-	-	-	+	-	+	-	+	-	+	-	+	+	-	-	+	+	+	-	-	+	+
P. cinchunae Sawada	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. hibernalis Carne	-	-	+	+	+	+	-	+	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Phytophthora species	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	+	-	-	+	-	+	-	+	-	-	-	+	-	+	+	-	-	+	+	+	-	-	-
Pythium	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P. echinulatum Ito	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. intermedium de Bary	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+
P. thalasium Atkins	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-
P. undulatum Petersen	+	+	+	+	+	+	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Pythium species	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pythiogeton	+	+	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-
P. transversum Minden	+	+	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Allomyces	-	+	-	+	+	+	+	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
A. arbuscula Butler	-	+	-	+	+	+	+	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
A. jaranicus Emer.&Wils.	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blastocladia	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pringsheimii Reinsch	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blastocladiella	-	-	-	+	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. simplex Matthews	-	-	-	+	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gonapodya	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. prolifera Fisher	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Olpidium Schroter	-	-	-	-	-	-	-	+	-	+	-	+	-	+	+	+	-	+	-	-	+	+	-	-	-	+	+	+	-	-	-	+	-	+	-	+	+	+	-	-	+	+	+	+	+	+
O. euglenae	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-	-	+	-	-	-	-	-	-	+	+	+	+	+	+
Rhizophydium sp.	-	-	-	-	-	-	-	-	-	+	+	+	-	+	+	+	-	+	-	-	+	+	-	-	-	-	-	-	-	-	-	+	-	+	-	+	+	+	-	-	-	-	-	-	-	-
Nowakowskia hormot. Borzi	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Pilobolus	-	-	+	+	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. kelinii Van Tieghem	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. nanus Van Tieghem	-	-	-	+	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Saprolegnia emerged in 15 months and contributed 11 species in addition to unidentified species. The richest months in *Saprolegnia* were of low and moderate temperature months. It disappeared completely during summer months. *S. ferax* and unidentified species were the most common species (11 and 10 months respectively). This result agrees with that obtained by Ismail *et al.* (24) who reported that *Saprolegnia* prefer lower temperature and thrive best in winter and the genus was completely absent in summer when water temperature was about 28°C. Similar results were obtained by Chaudhuri *et al.* (1947), Höhnk and Bock (23), Alabi (2, 3), Klick and Tiffany (33) and Khallil (32). On contrast, Lund (35) found that Saprolegnia did not seem to be dependent on temperature.

Phytophthora was of moderate occurrence (8 months) and contributed *P. hibernalis* (3 months) in addition to unidentified species (5 months).

Pythiopsis emerged in low temperature months (6 months) and was represented by two species. This result agrees with those obtained by El-Nagdy (16), El-Hissy (8-10), El-Hissy *et al.* (13) and Khallil (32) in this laboratory. On the contrary, Waterhouse (50) in England and Okane (1978) in Japan, reported that *Pythiopsis* was found throughout the year. *Allomyces* and *Isoachlya* were recovered only in comparatively lower temperature months. Khallil (32) reported that the richest seasons in *Allomyces* were spring and winter whereas the poorest was summer.

The remaining genera namely *Apodachlya, Bervilegnia, Thraustotheca, Gonapodya, Pythiogeton, Calyptralegnia, Leptomitus, Olpidiopsis, Rhizophydium, Olpidium, Woronina* and *Pilobolus Kleinii* were of rare or low frequency of occurrence (1-4 months).

Submerged mud

Thirty-seven species which belong to twenty aquatic fungal genera were recovered from monthly collected submerged mud samples. The richest periods in aquatic fungi were December 1981-May 1982, October-December 1982, January-March 1983 and October-December 1983 which represent moderate or low temperature month months (14-18°C). The poorest periods were from June-September 1982 and April-August 1983 which are almost summer months (21-27°C).

Dictyuchus, *Pythium* and *Phytophthora* were of high frequency of occurrence and emerged in (24, 24 and 16 months out of 24) respectively. The richest months in *Dictyuchus* were February and March 1982 and March 1983 (4, 5 and 4 species respectively). *Pythium* was also encountered throughout the experimental period and contributed four species only. *Phytophthora, Saprolegnia, Achlya, Brevilegnia, Aqualindrella, Pythiopsis, Rhizophydium, Olpidium, Nowakowskia* and *Pilobolus* emerged in 16, 10, 10, 9, 9, 8, 11, 7, 4 and 6 months respectively. Variable results concerning distribution and periodicity of aquatic phycomycetes in various soil and mud types all over the world were obtained by many investigators. In this respect, Rao and Venkateswarlu (43) in their study concerning microbial ecology of the soil of Indian desert, reported that no significant decline in the population of microorganisms was observed during summer, in spite of the high surface soil temperature which may sometimes reach 50°C.

Willoughby (53) in the United Kingdom, concluded that the moisture content of soil samples represents the main important factor in determining the occurrence of aquatic fungal flora in these samples. Lund (36) in Denmark, reported that the majority of aquatic fungi were isolated from the moist soil samples. El-Hissy (10) in Egypt found that the water content of the soil samples is an effective factor on the occurrence of aquatic fungi in soil.

It was interesting to isolate *Pilobolus*, which is known to be coprophilous, from water and submerged mud. It is probable that is spores were ejected from terrestrial mycelium to water where they could colonize the experimental baits and therefore it was recorded in this experiment.

In comparison between aquatic phycomycetes which recovered from surface water and submerged mud samples of the canal, it was found that; 1. *Achlya* was the most prevalent genus in water samples (23 months) while *Dictyuchus* and *Pythium* were predominated in submerged mud (24 months each). 2. *Apodachlya, Calyptralegnia, Gonapodya, Leptomitus* and *Woronina* emerged from water samples only while *Aqualinderella, Blastocladia, Blastocladiella, Leptolegnia and Nowakowskia* emerged from submerged mud. 3. *Achlya dubia, A. proliferoides, A. debaryana, A. caroliniana, A. polyandra, A. cambrica, A. oligacantha, A. apiculata, A. hypogyna, A. radiosa, Saprolegnia megasperma, S. anissospora, S. parasitica, S. diclina, S. furcata, S. turfosa, S. uliginosa, S. litoralis, Allomyces javanicus, Isoachlya monilifera, I. eccentrico* and *Pilobolus kleinii* emerged from surface water and disappeared in mud samples. 4. On the other side, *Pythium echinulatum, P. intermedium, Phytophthora cinchonae, Brevilegnia unisperma var. delica, Isoachlya unispora* and *Pilobolus nanus* recovered from mud samples only.

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