GEOFUNGI INHABITING ALKALINE PONDS

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ABSTRACT

Isolations of geofungi from the alkaline muddy soils collected from different ponds have been made. It yielded 102 species in which Deuteromycetes dominated the flora. The mycoflora does not differ much from other soils except for some quantitative differences. Occurrence of some of the genera, like *Achaetomium*, *Preussia* and *Tripterospora* indicates their preference to alkaline habitat. Aspergilli were found to outnumber all other genera ; next to it in order of abundance ranks the genus *Penicillium* followed by *Fusarium*. Significant variations in the fungal population in different months were found having no obvious influence of season.

INTRODUCTION

The presence of geofungi in an aquatic environment, which until recently has been considered an artifact, is being given due attention world over by the mycologists. Cooke (1959, 1961, 1968) has emphasized on their role in such an environment. Tabak and Cooke (1968) have also proved that the terrestrial fungi can survive and even grow in the absence of oxygen, and in reduced medium in an atmosphere of pre-purified nitrogen indicating thereby the ability of such fungi to inhabit and proliferate in an aquatic environment which provides somewhat similar conditions to the inhabitants. Park (1972 a, b) has added another dimension to such studies by describing the methods of isolation of geofungi from aquatic habitats and also emphasising the need for extensive studies.

Detailed taxonomic and ecological investigations on the fungi native to Indian alkaline 'Usar' soils have been made (Mukerji, 1966; Saksena *et al.*, 1967 a, b; Rai *et al.*, 1973, 1975; Rai & Agarwal, 1974; Rai & Chowdhery, 1978, 1979; Agarwal, 1973, 1975 a, b, c). However, such studies on terrestrial fungi inhabiting alkaline soils, which differ in many respects from the normal alkaline soils and provide an altogether different environment to the micro-organisms native to them, remained untouched. Therefore, the soils of six alkaline ponds were regularly analysed and screened for their microfungal flora for one complete year. In addition, various soil samples collected were also analysed for their physico-chemical properties. Seasonality in the fungal flora was correlated with varying ecological factors.

MATERIAL AND METHOD

Composite mud samples were aseptically collected at monthly intervals from six different ponds situated in an alkaline area in the outskirt of Lucknow city during the period from June 1978 to May 1979 (Fig. 1). Samples so collected were brought to the laboratory and subjected to microfungal analysis using the traditional methods. Culture plates were incubated at 28 ± 1°C. Colonies were counted from 3rd to 7th days of plating and picked up on slants containing the appropriate medium.

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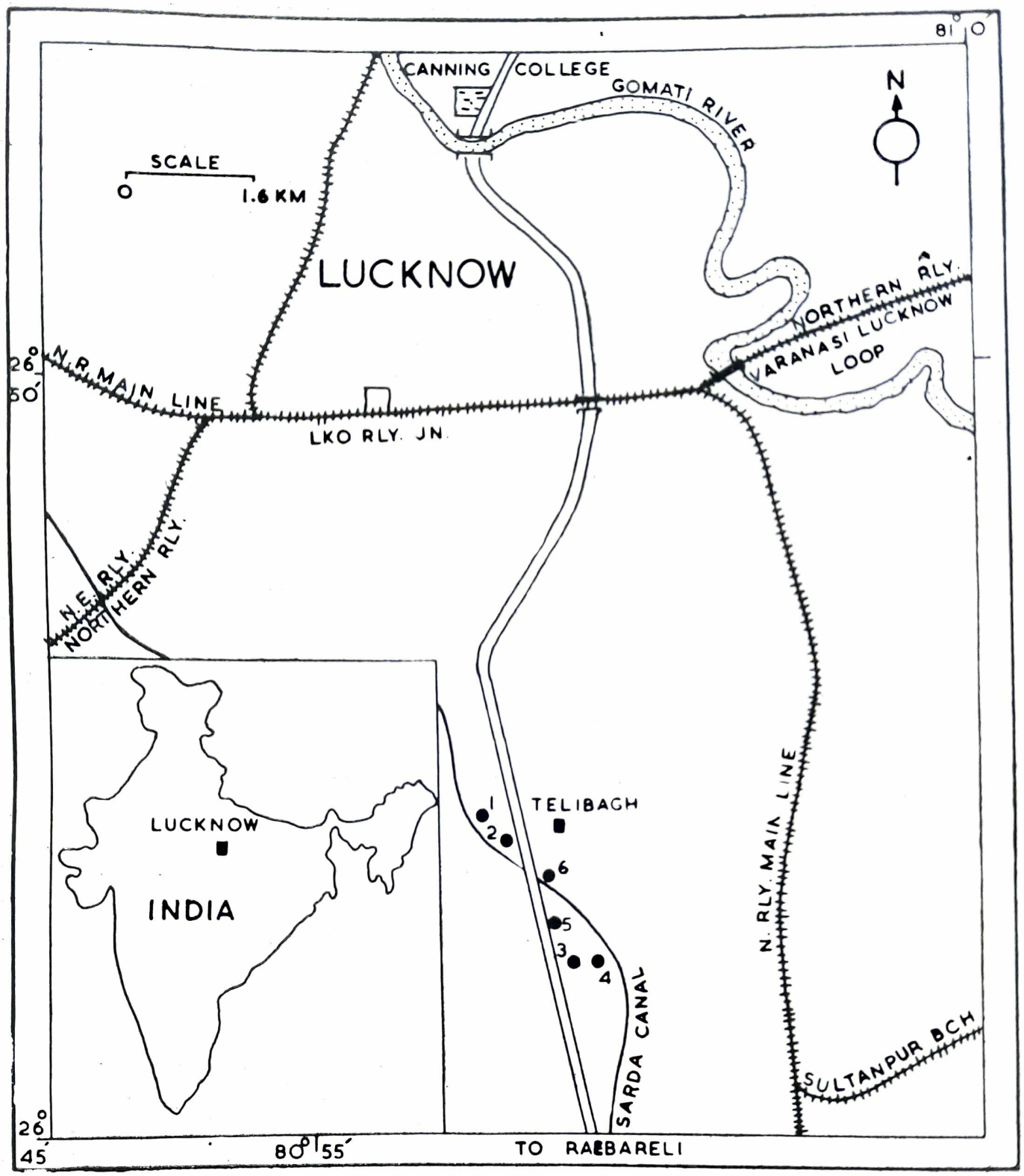

Fig. 1. Location map where from the mud samples were collected.

Soil pH was recorded by pH meter using glass electrodes and salinity by conductivity meter. Organic matter of the soil was determined by the method of WALKLEY AND BLACK (1934).

The frequency percentage of different fungal forms was calculated using the formula of TRESNER *et al.* (1954).

RESULTS

Table 1 shows per cent salinity, organic matter and pH of mud from six ponds

in different months. The pH value ranged from 7.5-9.0, while the per cent salinity from 0.1-2.7. Organic matter ranged from 0.1-3.7 per cent.

A total of 102 fungi were isolated, of these one belongs to Oomycetes, 9 to Zygomycetes, 26 to Ascomycetes (including ascosporic Aspergilli and Penicillia) and the rest to the dominant class of Deuteromycetes. Oomycetes is represented by a single genus, *Pythium*, of the order Peronosporales. The members of Zygomycetes belong to the order Mucorales representing 6 genera. Out of 26 species of Ascomycetes, 15 belonged to perithecial and 11 to cleistothecial types representing 12 genera. The class Deuteromycetes which dominate the fungal flora of the ponds is represented by 62 species belonging to 24 genera. Mycelia sterilia and *Rhizoctonia* sp. were also recovered.

Number of fungal colonies per gram of dry mud of different ponds in various months is given in table 2. These did not show any definite and regular trend of increase or decrease during different months. In ponds numbering 2, 5 and 6, higher number of colonies were recorded in the month of August, whereas in ponds number 1 and 3, it was in March, and during July in pond number 4. In other months, the fungal counts were comparatively lower.

Frequency percentage of various species in different months is shown in table 3 where it is evident that the genus *Pythium* was recorded throughout the year. Species of the genera *Absidia*, *Circinella*, *Cunninghamella*, *Mucor*, *Rhizopus* and *Syncephalastrum* showed higher frequency during July to October. However, in other months too, some of these forms were recorded, although individual periodicity pattern of the genera of Ascomycetes encountered varied; many of them were isolated during and after rains, i. e. July and December and January to March. Amongst the members of Deuteromycetes which were isolated throughout the year, the genus *Aspergillus* dominated all other forms; some of its species, namely *A. flavus*, *A. fumigatus*, *A. niger*, *A. terreus*, were found occurring in all the season of the investigated period, whereas others did not show any regular seasonal occurrence. Species of *Penicillium*, although occurred in varying months, showed higher percentage of occurrence during September to March. Other Imperfect-fungi did not show any definite distributional pattern. More so, no definite and discernible pattern of periodicity between dark and hyaline-spored fungi was observed.

DISCUSSION

Out of 102 forms isolated from alkaline muddy soils, many have been recorded from other soil types as well. This indicates their ubiquity and plasticity to adapt to varying conditions. The fact that micro-organisms develop certain degree of adaptibility and ecological specialization in relation to their habitat is well documented for the microfungi native to alkaline soils by RAI *et al.* (1970), RAI AND AGARWAL (1973, 1974) and in mangrove swamps by RAI AND CHOWDHERY (1976). Further, RAI AND CHOWDHERY (1978) reported the presence of quite a large number of microfungi (184 spp.) belonging to different groups from mangrove swamps of West Bengal. These observations fully support the presence of fairly good number of terrestrial fungi in the alkaline pond soils which also provide somewhat similar habitat to the fungi as studied by RAI AND CHOWDHERY (1978).

The presence of large number of terrestrial fungi in the muddy soils showing a wider spectrum of genera and species may be due to the fact that the fungal propagules are brought into them by the run-off water alongwith the soil particles and organic detritus which settle at the bottom of the ponds and become a part of the benthic population

in spite of adverse conditions perpetuating there. The high organic matter in the muddy soil of the ponds appears to be a factor of importance in getting these fungi adapted and established as a native mycoflora of such an alkaline and anaerobic environment. Similar explanations for the presence of larger number of fungi in varying unusual habitats have also been given (Tresner *et al.*, 1954; Miller *et al.*, 1957; Brown, 1958; Cooke & Lawrence, 1959; Mishra, 1966 and Rai & Chowdhery, 1978).

The pattern of dominance of different species of *Aspergillus*, *Penicillium* and *Fusarium* found in the present investigation is more or less the same as has been reported earlier (Swart, 1958; Rai *et al.*, 1969, 1971; Moubasher & Maustafa, 1970; Rai & Chowdhery, 1978; Moubasher & Abdel-Hafez, 1978a).

In the present study, no definite and regular pattern of increase or decrease in the number of the colonies per gram of dry mud of different ponds in various months of the year has been observed. Such varied and uneven maxima and minima of fungal counts in different months may atleast be attributed partly to the dynamic nature of the habitat studied.

In general, the sequence of maximum and minimum fungal counts and their individual periodicity pattern in different months (maximum in July, August and March; minimum in April-June and October-December) in ponds studied agree with earlier reports (Mishra, 1965, 1966; Saksena *et al.*, 1967a,b and Moubasher & Abdel-Hafez, 1978b) from other soil types. However, comparatively unusual higher fungal counts during the months of May-June (hotter months for India) and November to January (cooler months for this country) when colonies in poorer numbers are reported in other soils, may be due to the fact that temperature influences little both directly and indirectly the muddy soils of the ponds which are constantly under water cover. While different workers from all over the world have variously attempted to explain the seasonal fluctuations in the soil fungal population, workers like England and Rice (1957), Elkan and Moore (1960), Witkamp (1960) and Moubasher and El-dohlob (1970) in general believe temperature to be the major factor governing the fungal population in soil. But, it does not appear true for the present habitat.

Elliott (1930) apparently gave the first account of the fungi isolated from salt marsh sediments, an alkaline habitat having poor aeration, heavy clay soil wetted by inundating tide waters. The significant part of his observation was that more fungi are found in sediments with high organic matter than those with lower level of organic content, in spite of the stresses of salinity, poor aeration and high water contents. His findings further support the claim that fungi grow where nutrition is available despite "adverse" environmental factors (upto certain point). Similarly, Agarwal (1975c) also noted a direct correlation between the organic matter content of the alkaline soils and fungal population. In the present study also, organic matter appears to govern the fluctuations in the fungal population to a greater extent than other factors studied, i. e. salinity and pH which were not found much changing with the season. Soil moisture of the muddy soils which was found not much to be affected by the seasonal air temperature and was almost constant for the habitat studied, does not appear to limit the fungal population ecologically. However, the possibility of other inimical factors, possibly various pollutants reaching to the ponds with the run-off water, to come into play in affecting the fluctuations in the fungal population can not be ruled out for the habitat investigated.

Table 1—Per cent salinity (S), organic matter (O. M. w/w) and pH of muddy soil of six ponds

Ponds / Month	Lacchi Tara			Major's pond			Brood tank of F. F.			Rear tank of F. F.			Canal side pond			Junior High school pond		
	S	OM	pH	S	OM	pH	S	OM	pH	S	OM	pH	S	OM	pH	S	OM	pH
January	0.4	1.0	8.0	0.3	2.4	9.0	0.1	1.8	9.0	0.2	1.6	9.0	0.3	3.2	9.0	0.1	2.4	8.5
February	0.4	1.0	8.0	0.3	2.1	8.3	0.1	1.6	8.3	0.2	1.3	8.0	0.3	3.0	8.2	0.1	2.1	8.5
March	0.4	1.0	8.2	0.3	2.0	8.5	0.1	1.3	8.5	0.2	1.2	8.0	0.3	2.9	8.3	0.1	2.0	8.8
April	0.2	3.4	8.5	0.6	2.0	8.8	1.0	0.2	8.0	0.9	0.6	8.5	0.9	2.9	8.0	0.4	2.1	8.5
May	1.0	2.8	8.5	2.7	2.2	8.5	1.4	0.2	7.8	2.5	0.4	7.5	2.5	2.1	8.0	1.7	1.2	7.5
June	0.1	1.7	7.5	1.6	1.2	7.8	1.0	0.5	7.5	1.0	0.8	7.5	0.9	2.1	7.5	0.6	1.2	7.8
July	0.2	1.6	7.5	2.1	1.3	7.5	1.3	0.2	7.5	1.3	1.0	7.8	0.6	2.4	7.8	0.5	0.9	8.0
August	0.1	1.3	8.0	2.0	0.6	8.5	1.3	0.4	8.5	1.0	0.5	9.0	0.6	0.5	8.0	0.5	2.4	8.0
September	0.3	2.8	8.2	1.5	0.9	8.2	1.3	0.1	8.4	0.4	0.3	8.0	0.6	2.8	8.2	0.4	2.9	8.5
October	0.3	2.2	8.5	2.0	0.8	8.7	1.7	0.8	8.7	0.8	0.9	8.6	0.6	3.0	8.5	0.6	1.2	8.3
November	0.3	3.7	8.8	1.5	0.8	8.0	1.6	0.6	8.2	0.7	0.4	8.0	0.5	2.0	8.5	0.4	2.9	8.2
December	0.2	1.2	7.8	0.7	0.9	8.0	1.3	0.5	8.3	0.9	0.3	8.4	0.2	1.6	8.0	0.4	0.8	8.4

Table 2—Number of colonies per gram of dry mud of six ponds in different months

Pond / Month	1	2	3	4	5	6
January	38,571	34,285	31,250	27,142	33,333	38,333
February	52,857	42,857	40,000	34,285	60,000	50,000
March	58,571	61,428	42,857	27,142	41,666	45,000
April	28,571	28,571	11,250	18,571	33,333	23,333
May	10,000	32,857	11,250	21,428	28,333	21,666
June	24,285	25,714	10,000	24,285	60,000	60,000
July	27,142	61,428	17,500	45,714	50,000	60,000
August	21,428	64,285	17,500	27,142	73,333	63,333
September	20,000	38,571	21,250	27,142	28,333	43,333
October	12,857	20,000	25,000	27,142	23,333	38,333
November	57,142	47,142	26,250	18,571	61,666	28,333
December	38,571	28,571	31,250	18,571	33,333	23,333

Table 3—Frequency percentage of fungi in different months

Fungi	Month	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
		1	2	3	4	5	6	7	8	9	10	11	12
Absidia blakesleeana Lendner		..	33	16	..	..	..	83	83	66	33	..	16
A. corymbifera (Cohn) Sacc. & Trotter		33	33	..	..	..	..	66	66	..	33	..	16
Achaetomium luteum Rai & Tewari		50	16	33	..	..	..	33	33	16	..	..	50
A. strumarium Rai, Tewari & Mukerji		50	16	16	..	..	..	16	33	16	..	..	50
Acrophialophora nainiana Edward		..	..	..	..	..	..	..	33	..	..	..	..
Alternaria tenuis Nees		33	..	16	..	66	..	..	..	..	66	33	..
Aspergillus aeneus Sappa		..	16	16	..	..	..	..	..	..	16	33	..
A. carneus (v. Tiegh.) Bloch.		33	50	50	83	..	..	..	16	..	..	..	16
A. clavatus Desmazieres		..	..	..	..	..	..	16	16	33	..	..	..
A. flavipes (Bain. & Sart.) Thom & Church		..	..	..	..	16	33	33	83	..	..	..	..
A. flavus Link		16	33	83	16	16	83	50	50	100	100	83	33
A. fumigatus Fres.		83	100	83	100	100	100	100	50	66	33	66	83
A. japonicus Saito		33	16	..	..	..	33	33	..	..	33	33	50
A. nidulans (Eidam) Wint.		..	..	..	..	..	..	..	..	..	33	66	33
A. niger van Tieghem		33	33	33	33	16	83	83	66	16	16	16	16
A. niveus Bloch.		16	33	..	..	83	83	50	16	..	..	..	16
A. ochraceus Wilhelm		50	..	..	50	83	50	16	16	33	..	..	16
A. penicilliformis Kamyschko		33	33	50	16	..	..	..	16	33	50	..	..
A. phoenicis Cda & Thom		..	..	16	33	33	50	..	..	..	..	..	..
A. puniceus Kwon & Fennell		..	..	50	..	..	..	..	16	33	..	..	..
A. sclerotiorum Huber		..	..	33	50	50	83	50	..	..	16	..	..

A. sulphureus (Fres.) Thom & Church	16	33	33	..	83	83	50	50	..	..	16	33
A. sydowi (Bain. & Sart.) Thom & Church	..	..	16	33	50	83	83	16	..	..	16	..
A. tamarii Kita	33	16	..	..	..	..	..	..	33	50	33	..
A. terreus Thom	33	50	83	100	83	100	100	100	100	66	66	66
A. terreus var. *africanus* Fennell & Raper	..	..	33	..	..	..	16	33	..	..	..	..
A. terreus var. *globosus* Rai, Tewari & Agarwal	..	..	33	33	50	50	..	..	16	16	..	..
A. ustus (Bain.) Thom & Church	16	33	..	..	50	83	..	..	..	33	..	33
A. versicolor (Vuill.) Tiraboschi	..	..	50	..	83	..	50	83	50	..	..	16
Cephalosporium zonatum Sawada	..	..	16	16	..	..	..	..	..	..	33	..
Chaetomium arcuatum Rai & Tewari	16	33	..	..	..	..	33	50	50	..	..	50
C. funicolum Cooke	..	16	33	..	..	..	16	50	33	..	16	33
C. globosum Kunze	..	50	33	33	..	..	16	33	50	..	16	..
C. indicum Corda	16	33	..	50	..	..	33	..	16	16	50	..
C. lucknowense Rai & Tewari	..	..	16	33	..	..	83	..	..	33	83	16
C. nigricolor Ames	16	33	..	..	..	..	..	..	16	33	..	..
Circinella muscae (Sorakine) Berl. & de Toni	..	..	..	..	..	16	66	66	83	16	..	33
Cladosporium cladosporioides (Fres.) Devries	..	16	33	..	33	..	33	..	..	16	16	..
C. oxysporum Berk. & Curt.	..	..	16	16	33	..	..	..	..	..	33	16
Cunninghamella blakesleeana Lendner	..	..	50	..	..	..	83	83	50	..	..	..
C. echinulata Thaxter	..	16	16	..	..	..	50	66	66	..	..	33
Curvularia lunata(Wakker) Boedijin	33	33	..	16	16	..	33	..	..	66	33	..
C. penniseti (Mitra) Boedijin	..	16	33	50	..	..	..	33	..	50	50	..
C. tuberculata Jain	..	33	50	16	..	..	16	16	..	..	50	16
Dactylium fusarioides Frag. & Cif.	..	..	16	16	33	..	16	..	..	33	..	..
Doratomyces microsporus (Sacc.) Morton & Smith	..	..	16	16	33	..	16	..	..	33	..	..

Table 3—(*Contd.*)

Fungi	Month	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
		1	2	3	4	5	6	7	8	9	10	11	12
Emericella nidulans var. *lata* (Thom & Raper) Subramanian		33	16	16	..	..	..	..	..	66	83	66	83
E. rugulosa (Thom & Raper) Benjamin		16	33	16	..	..	..	..	..	66	16	16	33
E. striata (Rai, Tewari & Mukerji) Malloch & Cain		33	..	16	83	16	..	..	..	..	..	33	16
E. variecolor Berkeley & Broom		33	16	..	..	83	50	..	..	16	33	16	..
Eupenicillium brefeldianum (Dodge) Stolk & Scott		33	33	..	..	..	..	..	33	50	50	50	66
Eurotium amstelodami Mangin		16	33	..	..	..	..	..	16	..	..	..	16
E. chevalieri Mangin		..	16	..	16	..	..	..	33	..	16	33	50
E. rubrum Konig, Spiekermann & Bremer		..	..	33	16	33	50	..	..	66	..	33	16
Fusarium merismoides Corda		33	16	..	..	..	..	33	16	..	50	33	33
F. moniliformis Sheld.		50	16	..	16	..	33	..	..	50	..	..	50
F. oxysporum Schlecht. ex Fr.		..	33	..	..	..	..	..	50	66	..	16	..
F. semitectum Berk. & Rev.		66	16	..	33	16	16	..	..	33	..	16	16
F. solani (Mort.) Sacc.		33	..	50	..	..	50	..	..	66	50	..	..
Gilmaniella humicola Barron		..	..	50	..	16	16	33	16	..	..	..	..
Helminthosporium hawaiinse Bugn.		..	33	..	..	33	50	..	33	50	..	..	..
H. speciferum Nelson		33	16	..	..	..	..	..	..	..	33	50	50
Humicola fuscoatra Traaen		..	..	33	33	16	16	..	..	..	50	66	..
Memnoniella echinata (Rivolta) Galloway		..	..	33	..	..	50	50	..	..	16	33	..
Monilia sitophila (Montagne) Sacc.		33	..	33	16	..	..	16	33	16	..	..	..
Mucor fragilis Bainier		50	16	..	50	50	33	83	66	33	..	..	16

Table 3—(*Contd.*)

Fungi	Month	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
		1	2	3	4	5	6	7	8	9	10	11	12
Emericella nidulans var. *lata* (Thom & Raper) Subramanian		33	16	16	..	..	..	..	..	66	83	66	83
E. rugulosa (Thom & Raper) Benjamin		16	33	16	..	..	..	..	..	66	16	16	33
E. striata (Rai, Tewari & Mukerji) Malloch & Cain		33	..	16	83	16	..	..	..	..	..	33	16
E. variecolor Berkeley & Broom		33	16	..	..	83	50	..	..	16	33	16	..
Eupenicillium brefeldianum (Dodge) Stolk & Scott		33	33	..	..	..	..	..	33	50	50	50	66
Eurotium amstelodami Mangin		16	33	..	..	..	..	..	16	..	..	..	16
E. chevalieri Mangin		..	16	..	16	..	..	..	33	..	16	33	50
E. rubrum Konig, Spiekermann & Bremer		..	..	33	16	33	50	..	..	66	..	33	16
Fusarium merismoides Corda		33	16	..	..	..	..	33	16	..	50	33	33
F. moniliformis Sheld.		50	16	..	16	..	33	..	..	50	..	..	50
F. oxysporum Schlecht. ex Fr.		..	33	..	..	..	..	..	50	66	..	16	..
F. semitectum Berk. & Rev.		66	16	..	33	16	16	..	..	33	..	16	16
F. solani (Mort.) Sacc.		33	..	50	..	..	50	..	..	66	50	..	..
Gilmaniella humicola Barron		..	..	50	..	16	16	33	16	..	..	..	..
Helminthosporium hawaiinse Bugn.		..	33	..	..	33	50	..	33	50	..	..	..
H. speciferum Nelson		33	16	..	..	..	..	..	..	..	33	50	50
Humicola fuscoatra Traaen		..	..	33	33	16	16	..	..	..	50	66	..
Memnoniella echinata (Rivolta) Galloway		..	..	33	..	..	50	50	..	..	16	33	..
Monilia sitophila (Montagne) Sacc.		33	..	33	16	..	..	16	33	16	..	..	..
Mucor fragilis Bainier		50	16	..	50	50	33	83	66	33	..	..	16

M. racemosus Fres.	..	..	16	..	16	50	83	83	50	..	..	33
Myrothecium striatisporum Preston	..	..	..	16	16	..	16	..	..	50	..	..
Mycelia sterilia	33	33	66	16	16	..	16	..	..	50	16	..
Neocosmospora vasinfecta Smith	33	..	50	..	..	..	..	33	33	..	..	16
Nigrospora sphaerica (Sacc.) Mason	16	16	..	..	50	..	..	33	..	..	..	50
Paecilomyces fusisporus Saksena	33	..	33	..	..	16	33	83	..	50	..	..
P. persicinus Nocot	..	..	16	16	..	16	..	..	50	..	33	50
P. varioti Bain.	..	50	..	50	..	..	16	33	50	..	16	50
Penicillium chrysogenum Thom	33	50	..	..	..	16	..	..	33	83	50	16
P. citrinum Thom	16	..	33	..	..	..	..	..	..	50	50	83
P. cyclopium Westling	..	50	66	..	16	..	..	..	50	16	83	66
P. funiculosum Thom	50	83	66	..	..	..	50	..	..	33	50	..
P. pallidum Smith	83	16	50	..	..		16	50	50	..	16	16
P. piceum Raper & Fennel	..	..	..	16	..	..	..	83	..	50	66	33
Pestalotiopsis versicolor (Speg). Steyaert	16	16	..	..	..		..	..	..	83	..	33
Phoma eupyrena Sacc.	33	50	16	..	..	..	..	..	33	16	33	..
P. glomerata (Corda) Wr. & Hochapf	16	33	..	..	..	..	..	..	..	16	..	..
P. hibernica Grimes, O'Conner & Cummins	..	..	..	..	..	..	..	16	16	..	33	16
Phoma ushtrina Rai & Misra	..	..	..	16	..	..	..	16	33	..	..	..
Preussia globosa (Rai & Tewari) Rai & Tewari	..	..	33	..	..	..	33	66	83	16	50	..
Pythium sp.	16	16	33	16	16	16	33	66	66	16	16	16
Rhizopus arrhizus Fischer	50	50	..	..	..	16	50	50	83	..	..	33
Rhizoctonia sp.	..	..	50	..	..	..	..	33	16	..	..	33
Sartorya fumigata Vuillemin	33	16	..	..	..	33	50	33	..	..	..	..

Table 3—(*Contd.*)

Fungi / Month	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
	1	2	3	4	5	6	7	8	9	10	11	12
Scopulariopsis brevicaulis (Sacc.) Bain.	..	..	..	16	16	..	..	16	..	..	..	50
Sordaria humana (Fuckel) Winter	..	..	..	..	..	..	50	50	..	..	..	..
S. fimicola Ces. & de Not	16	..	16	33	..	..	..	16	..	..	..	33
Stachybotrys atra Corda	..	16	..	..	50	16	16	..	..	..	..	..
Syncephalastrum racemosum (Cohn.) Schroeter	33	50	16	..	..	16	33	50	50	83	16	..
Talaromyces stipitatus Thom ex Emmons	50	83	..	..	..	..	..	16	..	50	50	66
T. wortmanii Klocker	50	66	16	..	..	..	..	..	..	33	16	50
Thielavia sepedonium Emmons	33	16	16	..	..	..	..	..	50	..	50	33
T. terricola (Gilman & Abbott) Emmons	33	..	..	..	..	..	33	16	..	..	50	16
Trichoderma lignorum (Tode) Harz.	50	16	66	..	..	..	33	16	16	..	..	..
Trichothecium roseum Link	33	..	50	..	..	33	..	..	16	33	..	..
Tripterospora tetraspora Rai, Mukerji & Tewari	..	16	16	..	..	..	66	33	66	83	66	..

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