J. Indian bot. Soc. 50: 153–157, 1971.

FUNGAL POPULATION IN SUGARCANE SOILS—I

By Dhirendra Prakash and Abrar M. Khan
Department of Botany, A. M. U., Aligarh

Abstract

The number of fungal species, their frequency and the population of fungi decreased with increasing depths in sugarcane and uncultivated plots. Highest number of species were found between 2·5 to 7·5 cm.

More fungal species were isolated from plots under sugarcane cultivation than otherwise. The same held true for frequency and population.

The frequency and population in both cultivated and uncultivated plots was profoundly influenced by seasonal fluctuations. The frequency and population of fungi was high during July to September, moderate during October to March and low during April to June in both sugarcane and uncultivated plots.

Introduction

Some of the factors which influence soil mycoflora are depth, cultivation, moisture and soil temperature. Leclerg and Smith (1928), Warcup (1951, 1957), Stenton (1953), Miller et al. (1957) ; and Venkatesan (1964) observed that number of fungus species decreased with depth. Killian (1936) observed that fungal content of cultivated Algerian soil was more (156000/g) than the uncultivated (57000/g). Dixon (1930) observed that uncultivated sandy soil containd fewer Phycomycetes and a larger number of species of *Penicillium*, *Aspergillus* and *Trichoderma* than the cultivated ones. Nash et al. (1965) observed that *Fusarium solani* (Martius) Apple and Wollen-weber occurred in cultivated but not in uncultivated soils. Werkenthin (1916) and Brierley (1928), on the other hand, failed to observe any differences between the mycoflora of cultivated and uncultivated soils. Jasevoli (1924), Dixon (1929), Waksman (1944) and Ramakrishnan (1953) found a direct correlation between moisture content and the fungal numbers. Jensen (1934) found that the number of fungi increased with moisture content, whereas Eggleton (1938) observed that the number of fungi was independent of the moisture content.

As sugarcane is one of the most important crops of this region, a study of the fungi in sugarcane field at different depths and in different months of the year with respect to frequency and population was made. Similar studies were made in an adjacent uncultivated plot.

Material and Methods

Soil samples were collected at monthly intervals from sugarcane as well as uncultivated plot following the method of Warcup (1957). Samples were collected at 2·5 7·5, 15 and 30 cm depth. Five

1. Accepted for publication on September 2, 1970.

random samples were obtained for each depth and were thoroughly mixed into a composite sample. The soil was transferred with the flattened end of a needle to petridishes containing 10 ml of sterilized melted and cooled agar medium* (Warcup, 1950). The petridishes were then incubated at 28°C, and the fungi that developed after 5–7 days were examined and identified. The frequency of fungi was determined by the method suggested by (Sondhi, 1964). For determining the population, the soil held on a flattened tip of a needle was transferred to each plate and the average weight of soil per transfer was determined. The fungal population is expressed in numbers per gram of soil.

Results

At 2·5, 7·5, 15 and 30 cm depths from sugarcane plot the number of species of fungi isolated was 23, 23, 16 and 13 respectively, whereas from the uncultivated plot 15, 15, 13 and 12 for the corresponding depths (Table 1).

Cunninghamella verticillata Paine, *Mortierella alpina* Peyroud, *Rhizopus nigricans* Ehrenberg, *Mucor* sp., *Aspergillus niger* van Tieghem, *A. candidus* Link, *A. ustus* (Bainier) Thom and Church, *Penicillium corylophilum* Dierckx, *Chaetomium* sp., *Neocosmospora* sp., *Helminthosporium nodulosum* (Berkeley and Curtis) Saccardo, *Alternaria humicola* Oudemans, *Curvularia lunata* (Walker) Boedijn, *Pullularia* sp., *Stysanus stemonites* (Persoon) Corda, *Thielaviopsis* sp., *Phoma* sp., *Torula allii* (Harz) Saccardo, *Trichoderma lignorum* (Tode) Harz, *Hormiscium stilbosporum* (Corda) Saccardo, *Chaetophoma* sp., Oothecium sp., and *Fusarium* sp., were isolated from sugarcane plot from 2·5 and 7·5 cm depths; whereas from the uncultivated plot all the fungi except *Oothecium* sp., *Thielaviopsis* sp., *Phoma* sp., *Mucor* sp., *Neocosmospora* sp., *H. stilbosporum*, *M. alpina* and *Chaetophoma* sp., were isolated from these depths. In sugarcane plot at 15 cm depth *Mucor* sp., *A. ustus* *P. corylophilum*, *Neocosmospora* sp., *H. stilbosporum*, *M. alpina* and *Chaetophoma* sp., were absent, whereas at 30 cm depth *Oothecium* sp., *Phoma* sp., and *T. allii* were absent in addition to the above fungi. In uncultivated plot at 15 cm depth *P. corylophilum*, *A. ustus* and at 30 cm depth *Thielaviopsis* sp., were not isolated in addition to the fungi mentioned for these depths for the sugarcane plot.

Frequency of *C. verticillata*, *A. niger* and *H. nodulosum* decreased with increasing depths both in sugarcane and uncultivated plots. *A. humicola* was an exception as it showed high frequency values at lower depths. The above trend was true for majority of the fungi and in different months of the year. Further it was observed that the frequency of majority of the fungi was high in sugarcane plot in comparison to uncultivated plot.

It is evident from table 2 that the fungal population decreased with increasing depths in sugarcane and uncultivated plots. Higher population was observed in sugarcane plot than uncultivated plot. Similar pattern was found in different

*Glucose	10 g.
Agar Agar	20 g.
KNo_3	1 g.
$MgSo_4$	1 g.
K_2HPo_4	1 g.
* Rosebengal	1 : 30000
Distilled water	1000 ml (Khan and Siddiqi 1962)

* 1 g rosebengal dissolved in 300 ml water, 10 ml out of this solution was added to 1000 ml. medium.

months of the year.

Frequency of occurrence of *C. verticillata*, *A niger* and *H. nodulosum* in sugarcane and uncultivated plot was high during July to September, moderate during October to March, low during April to June at a depth of 2·5 cm. Similar results were obtained for majority of the fungi. Similarly the population of fungi at 2·5 cm was high during July to September, moderate during October to March and low during April to June at all the depths (Table 2).

Discussion

More fungal species, higher frequency values and higher fungal population were observed in sugarcane plot in comparison to adjoining uncultivated plot (Tables 1, 2). The number of fungal species, their frequency and the population decreased

TABLE 1

THE SPECIES IN FUNGI IN SUGARCANE AND UNCULTIVATED PLOTS AT DIFFERENT DEPTHS.

No.	Fungi	2·5 cm		7·5 cm		15 cm		30 cm	
		Sugar. plot	uncult. plot	Sugar. plot	uncult. plot	Sugar. plot	uncult. plot	Sugar. plot	uncult. plot
1.	*Cunninghamella verticillata*	*+	+	+	+	+	+	+	+
2.	*Aspergillus niger*	+	+	+	+	+	+	+	+
3.	*Helminthosporium nodulosum*	+	+	+	+	+	+	+	+
4.	*Curvularia lunata*	+	+	+	+	+	+	+	+
5.	*Chaetomium* sp.	+	+	+	+	+	+	+	+
6.	*Aspergillus candidus*	+	+	+	+	+	+	+	+
7.	*Alternaria humicola*	+	+	+	+	+	+	+	+
8.	*Pullularia* sp.	+	+	+	+	+	+	+	+
9.	*Oothecium* sp.	+	—	+	—	+	—	—	—
10.	*Stysanus stemonites*	+	+	+	+	+	+	+	+
11.	*Thielaviopsis* sp.	+	—	+	—	+	—	+	—
12.	*Phoma* sp.	+	—	+	—	+	—	—	—
13.	*Torula allii*	+	+	+	+	+	+	—	—
14.	*Fusarium* sp.	+	+	+	+	+	+	+	+
15.	*Mucor* sp.	+	—	+	—	—	—	—	—
16.	*Rhizopus nigricans*	+	+	+	+	+	+	+	+
17.	*Aspergillus ustus*	+	+	+	+	—	—	—	—
18.	*Penicillium corylophilum*	+	+	+	+	—	—	—	—
19.	*Neocosmospora* sp.	+	—	+	—	—	—	—	—
20.	*Trichoderma lignorum*	+	+	+	+	+	+	+	+
21.	*Hormiscium stilbosporum*	+	—	+	—	—	—	—	—
22.	*Mortierella alpina*	+	—	+	—	—	—	—	—
23.	*Chaetophoma* sp.	+	—	+	—	—	—	—	—

* + denotes presence and — denotes absence of a fungal species.

with increasing depths in both the sugarcane and uncultivated plots. There were no differences in the mycoflora between the samples taken from 2·5 and 7·5 mc depths. Marked seasonal fluctuations were noted in the frequency and the population of the fungi in both sugarcane and uncultivated plots. Frequency of occurrence and the population of fungi in both the plots was high during July to September and low during April to June. The high frequency of occurrence and high population during July to September could be attributed to moderate temperature and high moisture content; the low frequency and low population on the other hand, during April to June could be due to high soil temperature and low moisture content.

It is concluded from these studies that depth, cultivation, moisture and temperature influence the frequency and population of fungi.

TABLE II

THE POPULATION OF FUNGI IN SUGARCANE AND UNCULTIVATED PLOTS AT DIFFERENT DEPTHS AT MONTHLY INTERVALS.

Depth in (cms)	October Population		November Population		December Population		January Population		February Population		March Population	
	Sug. Plot	Uncult. Plot	Sug. Plot	Uncult. Plot	Sug. Plot	Uncult. Plot	Sug. Plot	Uncult. Plot	Sug. Plot	Uncult. Plot	Sug. Plot	Uncult. Plot
2·5	*35910	28940	30060	25060	29600	24050	28340	23570	36900	30060	37640	32000
7·5	33440	21140	29250	18270	27800	16760	25660	18100	32830	22640	33950	21900
15·0	25600	21400	21900	17300	20800	16900	20800	16030	23690	20410	24360	21100
30·0	14710	13270	13470	12800	12350	10980	12020	11300	14130	13100	13990	13450

Depth in (cms)	April Population		May Population		June Population		July Population		August Population		September Population	
	Sug. Plot	Uncult. Plot	Sug. Plot	Uncult. Plot	Sug. Plot	Uncult. Plot	Sug. Plot	Uncult. Plot	Sug. Plot	Uncult. Plot	Sug. Plot	Uncult. Plot
2·5	26470	22010	23160	18880	22330	16990	44850	36840	45970	35900	46050	37100
7·5	24920	16030	20450	15990	18990	14380	41630	28550	42660	29370	41900	30050
15·0	19369	16780	16900	14100	15460	13700	28800	22970	30700	24600	30500	25860
30·0	9680	9030	8200	7600	7900	6870	17900	15100	18500	14700	18860	15840

*Calculated on the basis of 20 replicate plates.

REFERENCES

*BRIERLEY, W. B. 1928. The microflora of the soil J. *Queket microsc. Cl* **26** : 9–18.

DIXON, D. 1929. The micro-organisms of cultivated and bush soils in Victoria. *Australian J. expt. Biol. med. Sci.* **3** : 223–232.

——. 1930. The micro-organisms of the tertiary red sands near Melbourne Victoria. *Ibid.* **4** : 161–169.

EGGLETON, W. G. E. 1938. The influence of environmental factors on numbers of soil micro-organisms. *Soil Sci.* **46** : 351.

JENSEN, H. L. 1934. Contributions to the microbiology of Australian soils. Numbers

*Original not seen.

of micro-organisms in soil, and their relation to certain external factors. *Proc. Linn. Soc. N. S. W.* **59** : 101–107.

JASEVOLI, G. 1924. Contribution all conscenzdegli ifomicetiterranoagratio. *Bull. Orto. Bot. Univ. Napoli.* **1** : 216–217.

KILLIAN, C. 1936. A study on the soil biology of the Algerian high plateaux. *Ann. Agron Paris* **4** : 595–614.

KHAN, A. M., AND M. A. SIDDIQUI. 1962. Fungal population in the soil and on the roots of sugarcane. *Indian J. Sugrcane. Res. Dev.* **6** : 176–178.

LECLERG, E. L., AND F. B. SMITH. 1928. Fungi in some Colorado soils. *Soil. Sci.* **25** : 433–441.

MILLER, J. H., J. E. GIDDENS, AND A. A. FOSTER. 1957. A survey of the fungi of forest and cultivated soils of Georgia. *Mycologia* **49** : 779–808.

NASH, M., SHIRLEY, AND W. C. SNYDER. 1965. Quantitative and qualitative composition of *Fusarium* populations in cultivated fields and non cultivated parent soils. *Can. J. Bot.* **43** : 939–945.

*RAMAKRISHNAN, K. 1953. *Soil Conditions and Fungal Wilts in Plants. The Distribution and behaviour of Fungi in the Soil.* Ph. D. Thesis Madras Univ.

SEWELL, G. W. F. 1959. Studies of Fungi in a Calluna-heathland soil I. Vertical distribution in soil and on root surfaces. *Trans. Br. mycol. soc.* **42** : 343–353.

SONDHI, J. K. 1964. *Rhizosphere Studies of Gram in Relation to Fusarium Wilt.* Ph. D. Thesis Agra Univ.

STENTON, H. 1953. The soil fungi of Wickenfen. *Trans. Br. mycol. soc.* **36** : 304–315.

VENKATESAN, R. 1964. The influence of soil depth on the microbial population of paddy soil. *Agric. Mag. Annamalai Univ.* **4** : 53–54.

WERKENTHIN, F. C. 1916. Fungus flora of Texas soils. *Phytopathology* **6** : 241–253.

WAKSMAN, S. A. 1944. Three decades with soil fungi. *Soil. Sci.* **58** : 89–115.

WARCUP, J. H. 1950. The soil plate method for isolation of fungi from soil. *Nature, Lond.* **166** : 117–118.

——. 1951. The ecology of soil fungi. *Trans. Br. mycol. Soc.* **34** : 376–399.

——. 1957. Studies on the occurrence and activity of fungi in a wheat field soil. *Ibid.* **40** : 237–262.

J. Indian bot. Soc. **50** : 157–161, 1971.

INFLUENCE OF SHADE ON THE GROWTH PERFORMANCE OF *SOLANUM NIGRUM L.*[1,2]

BY MANJULA SINGH (NEE' MANJULA VERMA)[3]

Botany Department, Banaras Hindu University, Varanasi–5

ABSTRACT

Both the varieties (Black and Red berried) of *S. nigrum* behave as heliophytes during winter (October to February) and Sciophytes during summer months (February to May). Maximum seed output per plant is obtained under open conditions during different seasons. Floral initiation takes place first in full sunlight. Light, therefore, seems to be a factor of primary importance as far as flowering and fruiting are concerned in and around Varanasi.

1. Accepted for publication on September 26, 1970.
2. The present work is a part of the thesis approved by Banaras Hindu University, Varanasi.
3. Present address : Post Doctorate Research Scholar, Botany Branch, F. R. I., Dehra Dun.

The author is highly thankful to Dr K. C. Misra, Reader and Prof. R. Misra, Head of the Botany Department, Banaras Hindu University, Varanasi, for their guidance, corrections and criticisms. She is also thankful to the Director, Post Graduate Institute of Indian Medicine, for the award of fellowship during the tenure of the present investigations.