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ADDITION TO CELLULOLYTIC FUNGI : SOIL-INHABITING ASCOMYCETES OF ASSAM AND MEGHALAYA

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In connection with screening of cellulolytic fungi, active in a soil of Assam and Meghalaya, a systematic study was undertaken and a large number of fungi belonging to different groups were isolated. The present paper describes cellulolytic activity of only the ascomycetes recorded in this study. Among the 21 species of ascomycetes, three species which are hitherto unrecorded as active cellulose destroying fungi, were found to be high cellulose decomposing.

INTRODUCTION

Fungi, which inhabit abundantly in soil decompose the cellulosic materials actively. Fungal growth on susceptible materials is very common and it is accelerated considerably, if sufficient nutrition is available to the growing fungi together with the favourable environmental conditions, as a result, a wide variety of cellulosic materials are deteriorated by fungi in India and elsewhere. It is clear from the literature that the fungi found associated with large number of fibres, textiles and other cellulosic materials, differ in their capacity of cellulose degradation. Some of them are highly cellulolytic while others are comparatively less so.

Studies presented in this paper are confined to isolation of different species of ascomycetes from the soils of different localities of Assam and Meghalaya and their screening against the cellulose degradation. The species, which proved to be cellulotytic, were further tested for their relative cellulose degradation capacity against different cellulosic materials.

MATERIALS AND METHODS

All the 58 isolates, which were isolated from the soil samples of different localities of Assam and Meghalaya were taken for the study. These isolates were individually grown on cambric cotton test strips, suspended on a glass rod placed obliquely in a flask having Greathouse's medium (Greathouse *et al.*, 1942) under identical experimental conditions for the determination of cellulolytic activity. The cellulolytic activity was determined following the method described in Technical Report (Anon., 1947) and the breaking strength of test strips was determined at a Good brand breaking strength testing machine (Anon., 1959). The

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TABLE I

Maximum cellulose destroying capacity of individual fungi

Fungus	*Visible growth on cambric strip	**Breaking strength of strip in kg	%Loss in breaking strength of strip
Chaetomium globosum	++++	7·8	77·81
Byssochlamys nivea	++++	9·1	74·00
Petriellidium sp.	++++	12·9	63·14
Pseudoeurotium indicum	+++	15·6	55·42
Chaetomium indicum	+++	16·8	52·00
Anixiella reticulata	+++	17·1	51·05
Sordaria humicola	+++	18·2	48 00
Carpenteles brefeldianum	+++	18·6	46·85
Emericella rugulosa	+++	20·0	42·85
Ascotricha chartarum	+++	21·0	40·00
Neurospora dodgei	++	21·3	39·14
Emericella nidulans	++	22·0	37·14
Carpenteles parvum	++	22·0	37·14
Neurospora tetrasperma	++	22·5	35·71
Carpenteles javanicum	++	22·7	31·14
Sartorya fumigata	++	25·8	26·28
Emericella quadrilneata	+	29·8	14·85
Nectraria haematococca	+	29·9	14·57
Monascus ruber	+	30·9	11·71
Emericella variecolor	+	31·1	11·14
Microascus cinereus	+	32 3	07·70

+Poor growth; ++, Fair growth; +++, Good growth; and ++++, Abundant growth

** =Mean of Six replications.

average breaking strength of inoculated, uninoculated (control) strips was used for calculating percentage loss in strength of cotton test strips.

Different cellulosic materials, cotton fibres, white drill, cotton cordage, gunny bags, ruled paper, bamboo paper, paper pulp and pine wood were taken for studying the comparative activity of high cellulose decomposing fungi and were tested by pure culture test (Nigam, 1965).

RESULTS AND DISCUSSION

All the isolates which were screened for the determination of cellulolytic activity showed variable behaviour. Out of 58 isolates one was non-cellulolytic in nature e.g. *Monascus ruber*, while the remaining isolates were cellulolytic in nature and showed their cellulose degradation capacity from 1 to 80 percent. None of the ascomycetes isolates gave more than 80 percent activity.

The results indicate that the maximum activity was shown by the isolates of *Chaetomium globosum* (77.71%) although different isolates of this species showed slight variation. Similarly, isolates of *Byssochlamys nivea*, *Petriellidium* sp.,

TABLE II

Growth of some selected fungi on different cellulosic materials

Incubation temperature 28 ± 2°C

Incubation period 14 days

S. No.	Fungus	Cellulosic materials tested							
		Cotton fibre	White drill	Cotton cordage	Gunny bag	Ruled paper	Bamboo paper	Paper pulp	Pine wood
1.	*Anixiella reticulata*	++	+++	+++	+	+	+	+	—
2.	*Pseudoeurotium indicum*	—	++	+	—	++	+	+	—
3.	*Chaetomium globosum*	+++	+++	+++	++	+++	+++	+++	+
4.	*C. indicum*	++	+++	+++	++	+++	++	++	+
5.	*Byssochlamys nivea*	+	+++	++	+	++	+	+	—
6.	*Petriellidium* sp.	+	++	++	+	+	+	+	—

—, No growth; +, Poor growth; ++, Moderate growth; +++, Profuse growth

Pseudoeurotium indicum, Chaetomium indicum, Anixiella reticulata also exhibited significant loss in test strips and maximum losses presented by these isolates were 74.00, 63.14, 55.42, 52.00 and 51.05 percent respectively (Table-I), whereas, isolates of *Sordaria humicola, Carpenteles brefeldianum,Emericella rugulosa* and *Ascotricha chartarum* exhibited 48.00, 46.85, 42.85, and 40.00 percent losses respectively. *Emericella variecolor, E. quadrilineata, Nectaria haematococca, Monascus ruber* and *Microascus cinereus* showed poor response.

From the above results, it is obvious that the fungal species could be grouped into 4 categories, i.e. (A) non-cellulolytic—which did not give any percentage loss in strength, (B) weakly cellulolytic—which gave 1 to 49.9% loss of breaking strength, (C) moderately cellulolytic—which gave 50.0 to 79.9% loss in breaking strength, and (D) highly cellulolytic forms—which gave 80 to 100% loss of breaking strength. All those species which are grouped in moderately and highly cellulolytic forms were taken for screening against various cellulosic materials.

Results of these studies (Table II) indicate that out of 8 cellulosic materials, white drill, cordage cotton, ruled stationery paper, bamboo paper and paper pulp supported the growth of all the fungi tested, while the rest did not support the growth of all the test fungi. The pine wood was the only cellulosic material, which showed some resistance against most of the fungi although certain species i.e. *Chaetomium globosum* and *C. indicum* degraged the wood cellulose. The data indicate that cotton fibres and gunny bag were not affected by *Pseudoeurotium indicum*. It is quite evident from the results that *Chaetomium globosum C. indicum, Anixiella reticulata, Byssochlamys nivea* and *Petriellidium* sp., were highly cellulolytic in nature and were able to deteriorate the various cellulosic materials used for testing.

It is evident from literature (Ames, 1951; Bharti & Yadav, 1973) that *Chaetomium* sp., *Byssochlamys* sp. and *Ascotricha* sp. were among those which mainly represented the group for the active deterioration of cellulosic materials. Greathouse and Ames (1945) described 13 species of *Chaetomium* associated with deterioration of fabric. Ames (1951) listed 4 species of *Ascotricha* as cellulolytic forms.

Large number of ascomycetes described as cellulolytic in nature belonged to *Chaetomium, Sordaria, Sartorya, Byssochlamys, Neurospora, Ascotricha, Anixiella, Emericella* and *Carpenteles* species (Pugh *et al.*, 1963; Fergus, 1969; Chahal & Gray, 1969; Nigam *et al.*, 1972; Bharti & Yadav, 1973; Agarwal, 1975 and Agarwal & Chauhan, 1976)—but without the indication of any activity of *Pseudoeurotium indicum, Anixiella reticulata* and *Petrillidium* sp. Thus these 3 species are newly added ascomycetes as cellulose decomposers from the present studies.

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