MICROBIAL DETERIORATION OF FIRE PIPE HOSE—PART 1.

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One species each of *Penicillium* and *Memnoniella echinata* isolated from deteriorated fire pipe hose has been found to be predominantly responsible for its degradation. Their degradative effect separately as well as in combination has been studied. This paper summarises the results of the studies on the microbial deterioration of fire pipe hose and describes the main types of fungi responsible for its degradation during storage.

Fire pipe hoses used in the Services in India are made of flax fibres only and are liable to undergo microbial attack during storage and under user conditions in humid regions. According to Ross *et al.*[1] abrasion as well as microbial deterioration are the two chief factors responsible for rendering the fire pipe hose unserviceable. For effective use of fire pipe hoses it is essential that utmost care should be taken to protect them from deterioration.

MATERIALS AND METHODS

A roll of fire pipe hose (No. 8081, J.S.T., $2\frac{3}{4}$": 24 ply: 10 R.F.T) and made of flax fibres was used and the studies on its microbial susceptibility were carried out on Greathouse[2], Potato dextrose agar[3] and Martin's[4] media in the tropic room[5]. The pattern of degradation during soil burial was also studied.

Microbial Susceptibility Test

Pieces, approximately 4" ×4", were cut from the hose and placed on glass beads in petri dishes (6" in diameter) containing enough water to maintain saturated humidity.

Six replicates of these petri dishes were incubated in the laboratory tropic room maintained at cyclic temperatre of 28° to 32°C and R.H. 90% to 95%. After 14 days of incubation, the degree of fungal growth was visually observed and the fungi identified by microscopic examination. These included species of *Asperbgillus, Penicillium, Rhizopus and Memnoniella.*

Degradation during Soil Burial

The test specimens (size 24" ×3") were buried in composted soil[6] having moisture content of 25% to 30% for a period of 28 days and incubated in the tropic room.[7] The analysis of the soil and the flora associated with it are given in the earlier paper[6]. After the incubation, the test pieces were taken out and microscopically examined. *Memnoniella echinata and Penicillium* sp. [D.R.L. (M), Kanpur culture Nos. 843 and 844] were found to be predominantly growing. The breaking strength of the pieces was also determined as per I.S. Specification No. 1389 (1959). The results are given in Table I.

TABLE 1

BREAKING STRENGTH IN LBS. OF FIRE PIPE HOSE AFTER 28 DAYS OF SOIL BURIAL

Serial No.	Replicates	Degree of growth	Average B.S. in lbs.	% loss	Organisms observed
1	A	Profuse growth	110	15%	*Penicillium* sp.
	B	Profuse growth			*M. echinata*
2	C	Profuse growth	103		*Penicillium* sp.
	D	Profuse growth		24%	*M. echinata*
3 (Control)	E	No growth	133	..	..
	F	No growth			

Rate of Deterioration by the Fungi Isolated from the Hose :

Memnoniella echinata and *Penicillium* sp. isolated from the fire pipe hose were found to cause maximum degradation. Their deteriorating effect was studied individually as well as collectively using Martin's medium.[4] The samples were subjected to 28 days of incubation at 30°± 2°C. The results of the loss in the breaking strength are given in Table 2.

TABLE 2

PERCENTAGE LOSS IN BREAKING STRENGTH OF THE FIRE PIPE HOSE DUE TO *Penicillium* sp. 844 AND *Memnoniella echinata* (843) BOTH SEPARATELY AS WELL AS COLLECTIVELY

Serial No.	Organisms inoculated	Replicates	Degree of growth	B.S. in lbs.	Average B.S.	% loss	Remarks
1	Control	A	No growth	370			*Ommitted in average.
		B	No growth	680*	425 lbs.	..	
		C	No growth	480			
		D	Profuse growth	50			
2	*M. echinata*	E	Profuse growth	75	63 lbs	85%	..
	Culture No. 843	F	Profuse growth	65			
		G	Profuse growth	..			B. S. could not be done as the samples got totally damaged.
3	*Penicillium* sp.	H	Profuse growth		..	100%	
	Culture No. 844	I	Profuse growth	..			
4	*M. echinata* & *Penicillium* sp.	J	Profuse growth	..			
		K	Profuse growth	..		100%	do.
	Culture Nos. 843 & 844.	L	Profuse growth	..			

It will be observed from the Table 2 that *Penicillium* sp. and *Memoniella echinata* caused damage upto 100% and 85 % respectively. Out of these two organisms, *Penicillium* sp. appeared to be more active.

Rate of Degradation using the two Fungi on Different Media.

Martin's,[4] Potato-dextrose-agar[3] and Greathouse[2] broth media were used for studying the extent of damage caused by the two fungi under similar laboratory conditions. The test pieces were incubated at 30°±2°C for a period of 28 days after which these were taken out and the breaking strength determined. The results are given in Table 3.

TABLE 3

EFFECT OF DIFFERENT MEDIA ON THE LOSS IN BREAKING STRENGTH OF THE FIRE PIPE HOSE

Medium	Organisms inoculated	Degree of growth	% loss
	Memnoniella echinata (*843*)	Moderate growth	14%
	Penicillium sq. (*844*)	Moderate growth	23%
Greathouse broth			
	M. echinate and Penicilliumsp. (*843* & *844*)	Profuse growth	14%
	M. echinate (*843*)	Profuse growth	41%
Potato dextrose	*P enicillium sp.* (*844*)	Profuse growth	44%
agar	*M. echinata and Penicillium sp.* (*843* & *844*)	Profuse growth	59%
	M. echinata (*843*)	Profuse growth	85%
Martin's			
	Penicillium sp. (*844*)	Profuse growth	100%
Medium			
	M. echinata and Penicillium sp. (*843* & *844*)	Profuse growth	100%

The maximum loss in the breaking strength of the hose occurred on the Martin's medium and the minimum in the Greathouse. Visually there was practically no difference in the degree of fungal growth over the fire pipe hose pieces in the three Media. The extent of degradation on a single fibre of the fire pipe hose on the Martin's medium is shown in figure 1.

Degradation of Fire Pipe Hose due to Penicillium sp. *& M. Echinata in Soil*

The degradation of fire pipe hose in sterilised soil inoculated with the two fungi separately and collectively was studied (see Fig. 2) as per the usual soil burial method

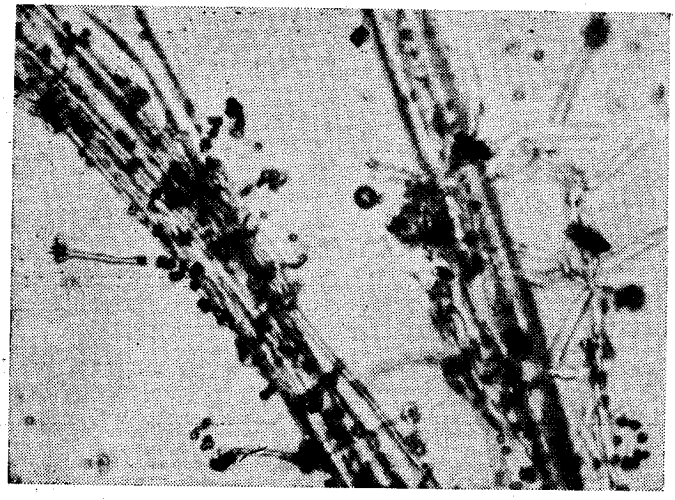

FIG. 1—Extent of degradation on a single fibre of the fire pipe hose on the Martins medium.

described in Indian Standard Specification IS:1359 (1959)*. The loss in both the cases was almost the same (100% and 97% respectively) within a period of 28 days at 30°±2°C.

FLAX CANVAS HOSE IN SOIL

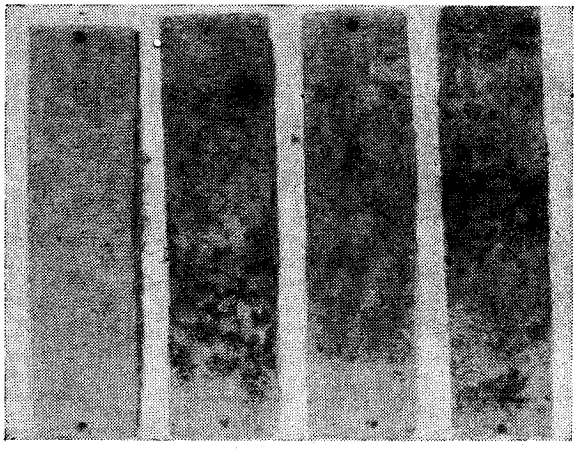

FIG. 2—Flax canvas Hose in soil. A (control); B (*Memnoniella* sp); C (*Penicillium* sp); D (*Memnoniella* sp and *Penicillium* sp).

*Pieces were also simultaneously buried in composted soil rich in microflora.

However, the pieces buried in unsterilised soil were also found to be covered with *M. echinata* and *Penicillium* sp. This is a clear indication that the two fungi are predominantly responsible for the degradation of fire pipe hose.

The pattern of degradation of fire pipe hose in soil has also been studied for periods ranging from 1 week to 4 weeks. The results are plotted in figure 3.

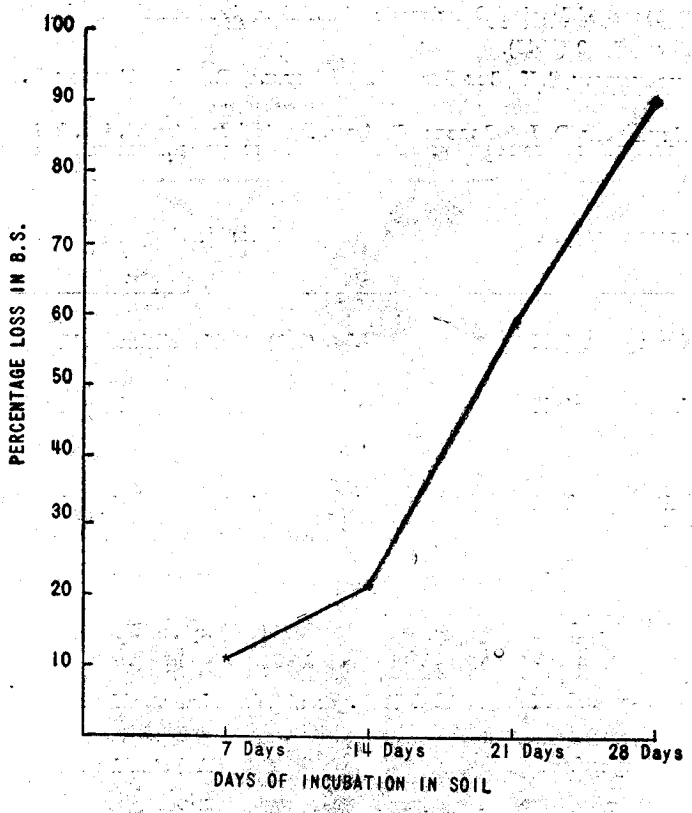

FIG. 3—Pattern of degradation of hose in soil inoculated with a mixture of spores of *M. echinata* & *Penicillium* (sp).

DISCUSSION

Incidence of microbial damage in unlined flax forestory hose (the usual fire pipe hose) has been found to be a major factor in the degradation both during storage and user conditions[1]. These investigations have revealed the effect of predominant activity of the two fungi *i.e. M.echinata* & *Penicillium* sp. (843 & 844) in the degradation of fire pipe hose. These two fungi have been found to bring about major degradation of the fire pipe hose. Studies regarding the protective treatment against the microbial damage are in progress.

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