

# DEGRADATION OF WOOLLEN FABRIC BY THE FUNGUS *CTENOMYCES* SPECIES: PART-1.

(FACTORS INFLUENCING THE GROWTH AND ACTIVITY OF THE FUNGUS)

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The influence of various factors, viz. temperature, pH and period of incubation on the growth of the fungus *Ctenomyces* sp. and on its activity with regard to the degradation of serge white lining (woollen fabric) has been studied. The results indicate that the growth and activity of the organism were maximum at temperatures near about 30°C. The variation in pH (from 2.3 to 7.0) of the medium does not seem to influence the growth and/or activity of the organism. Increase in the period of incubation from 4 to 24 days steadily increased the growth and activity of the organism.

The fungus *Ctenomyces* species was first isolated in this laboratory by Sen Gupta *et al.*<sup>1</sup> in 1948 from deteriorated, woollen Service store. The morphology, nature of growth and other characteristics of this organism have also been described by Sen Gupta *et al.*<sup>1</sup> These authors also reported that this organism brings about a loss in breaking strength of "cloth collar white" to the extent of 93% in 14 days and suggested that the fungus can be used as a test organism for evaluating the efficiency of rot-proofing treatment on wool. The present communication embodies the results of a study on the influence of various factors such as temperature, pH and period of incubation on the growth and activity of this organism.

## MATERIALS AND METHODS

**Woollen fabric**—Serge white lining, weighing 8 oz. per sq. yd, was taken for the present investigations. Test pieces of serge white lining of size 2" × 2" each were cut warpwise and weighed giving due allowance for the moisture content of the pieces.

**Reagents**—The reagents used in connection with this work were of A.R. quality.

**Procedure for growing the organism**—Weighed pieces of serge white lining were put separately in 250 ml. Erlenmeyer flasks over a layer of glass beads and 20 ml. of the Thornton's medium,<sup>2</sup> modified by substituting MgCl<sub>2</sub> in place of MgSO<sub>4</sub> and eliminating asparagine and potassium nitrate altogether, was added into the flasks. The composition of modified Thornton's medium is given below. The flasks were then sterilized at 15 lbs./sq.in pressure for 15 minutes. The flasks were cooled and inoculated with the freshly grown culture of *Ctenomyces* sp. [DRL (M), Kanpur culture No. 381]. The culture was maintained in the potato-dextrose agar<sup>3</sup> tubes and was grown at 30° C ± 1°C for 10 days. The inoculated flasks were kept in an incubator at different temperatures for various periods of growth. The loss in weight of the woollen fabric and the amount of mycelium formed after 10 days of growth were determined for each set of experiment.

*Composition of modified Thornton's medium.*

Glucose	1.0 gm	} in 1000 ml. pH 5.8
MgCl <sub>2</sub>	0.2 gm	
NaCl	0.1 gm	
CaCl <sub>2</sub>	0.1 gm	
K <sub>2</sub> HPO <sub>4</sub>	1.0 gm	

In this medium the woollen fabric was the only source of nitrogen. The fungus was also grown on the synthetic medium whose composition was the same as above excepting that 10 gm of peptone and 1.0 gm of cystine were also added.

*Determination of quantity of mycelium formed and the loss in weight of woollen fabric.*—It was observed that the mycelial mat was formed tenaciously adhering to the woollen fabric and hence it could not be easily separated out from the damaged fabric after growth. In order to determine the loss in weight of the fabric, the fungus was grown for 10 days on the synthetic medium described above. The mycelial mat obtained after 10 days of growth was separated from the metabolic liquor by filtration through a Buchner funnel, washed with distilled water until free from adhering materials. A known amount of mycelial mat dried at 70°C under vacuum, was dissolved in 100 ml. of boiling 10% caustic soda solution. A part of the mycelium dissolved out in the caustic soda solution. The mycelium left undissolved was washed with water until free from alkali, dried at 70°C under vacuum and weighed to a constant weight. The percentage of mycelium which was left undissolved in the alkali was calculated. The degraded woollen fabric together with the mycelium after ascertaining the dry weight were also treated with 100 ml. of boiling 10% caustic soda solution. The entire wool together with some mycelium went into the solution. The mycelium which remained undissolved in the alkali solution after filtration and washing was dried and weighed. From these determinations the loss in weight of the woollen fabric and the amount of mycelium formed were calculated.

## RESULTS AND DISCUSSION

*Effect of temperature on the growth of the fungus*—The loss in weight of the woollen fabric and the quantity of the mycelium formed on incubation for 10 days at various temperatures ranging from 27 to 40°C and pH 5.8 are shown in figures 1 & 2. It is apparent from these figures that the temperatures close to 30°C are quite favourable for the growth and activity of the organism. However, the growth and the activity of the fungus are retarded at temperatures higher than 35°C.

*Effect of pH on the growth and activity of the fungus*—The loss in weight of the woollen fabric and the amount of mycelium formed on incubation for 10 days at various pH values ranging from 2.3 to 7.0 at 27°C are summarised in Table 1.

TABLE I

EFFECT OF pH ON THE GROWTH AND ACTIVITY OF THE FUNGUS, *Ctenomyces* Sp.

pH of the medium	Amount of mycelium in mgms	% loss in weight of woollen fabric
2.3	92.3	26.9
3.5	86.4	25.0
4.6	78.2	24.0
5.8	90.4	27.3
7.0	84.6	25.0

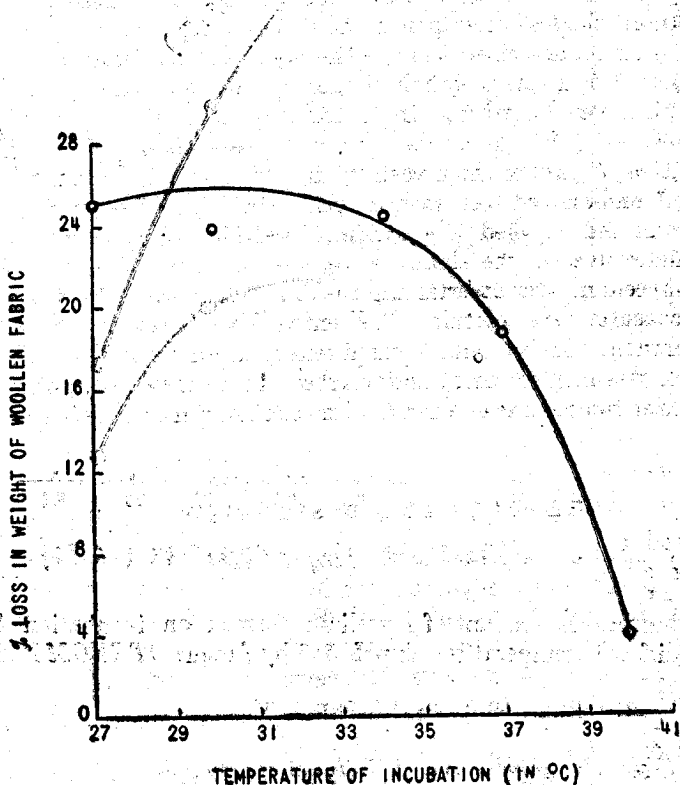


FIG. 1—Showing loss in weight of woollen fabric by *CTENOMYCES* Sp. on incubation for 10 days at different temperatures & pH 5.8.

The results in Table 1 indicate that the organism grows fairly well over a wide range of pH and the percentage loss in weight of the woollen fabric does not vary significantly with variation in pH from 2.3 to 7.0. This suggests that the growth and activity of the organism are not much influenced by the variation in the pH of the medium within the range investigated. Statistical analysis of these results also lead to the same conclusion.

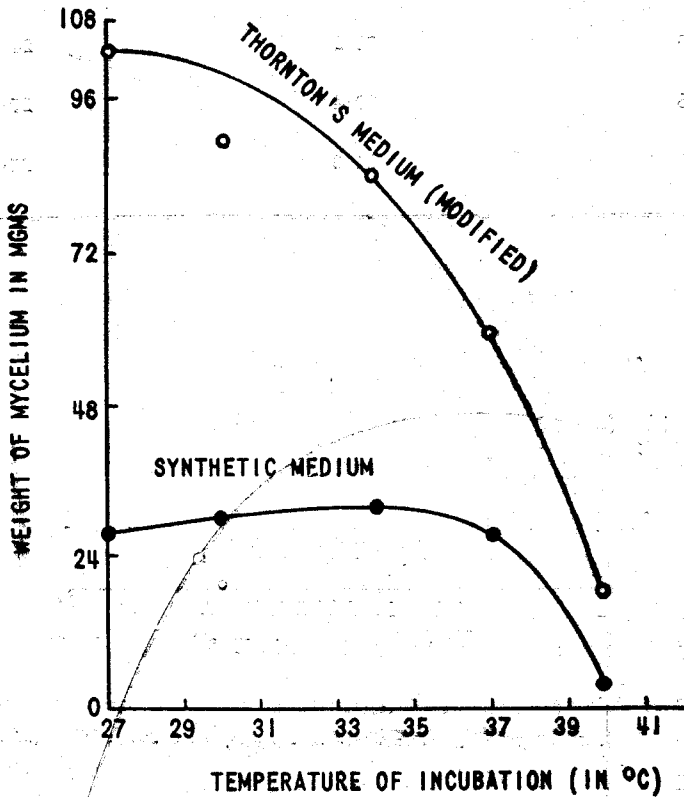


FIG. 2—Showing the amount of mycelium formed on incubation for 10 days at different temperatures & pH 5.8 by fungus *CTENOMYCES Sp.*

Effect of period of incubation on the growth of the organism and the rate of degradation—Values for loss in weight of serge white lining and amount of mycelium formed at 27°C and pH 5.8 by the fungus *Ctenomyces* after various stages of digestion are illustrated in

figures 3 & 4. It appears from these figures that the extent of degradation and the growth of the fungus increase with the increasing period of incubation. The maximum degradation has taken place in 24 days. It is also observed that the organism is a slow growing one.

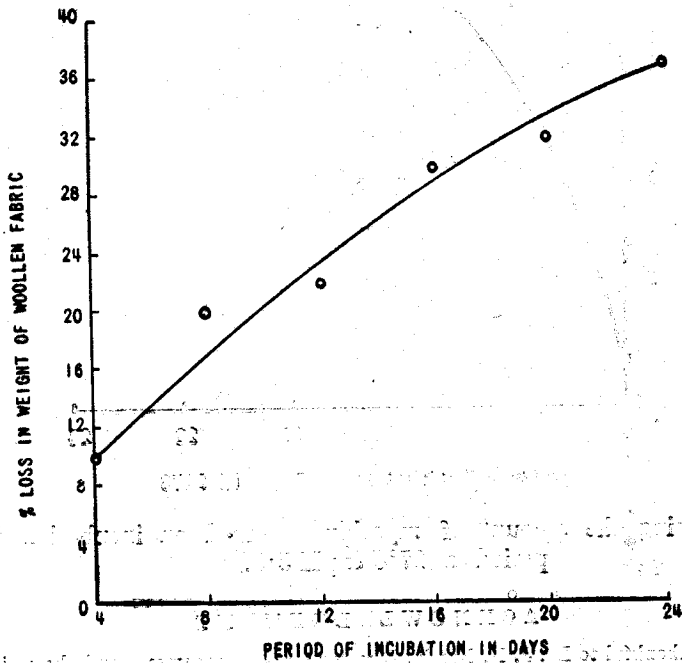


FIG. 3—Showing the loss in weight of woollen fabric on incubation by fungus *CTENOMYCES* for different periods at 27° C. & pH 5.8.

#### CONCLUSION

These investigations show that the growth and activity of the fungus *ctenomyces* are maximum at temperatures close to 30°C while at higher temperatures the growth and the activity decline. The variation of pH from 2.3 to 7.0 does not influence the growth and activity of the organism. The extent of growth and degradation of woollen fabric increases with the increasing period of incubation.

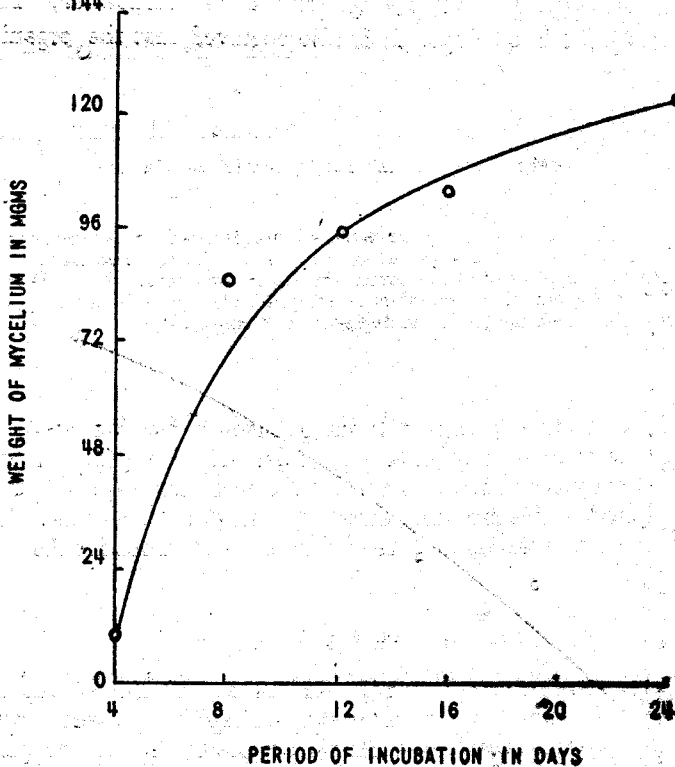


FIG. 4—Showing the amount of mycellium formed on incubation for different periods at 27°C & pH 5.8.

#### ACKNOWLEDGEMENT

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