XCI. STUDIES OF THE BACTERIAL DECOMPOSITION OF TEXTILE FIBRES.

IV. NOTE ON THE ACTION OF *B. SUBTILIS* AND *B. MESENTERICUS* ON CELLULOSE.

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TROTMAN and SUTTON [1924] reported that they had found *B. subtilis* and *B. mesentericus* capable of decomposing the cellulose of cotton hairs.

Their work was repeated at this laboratory shortly after its publication without any evidence being obtained in support of their statements [Thaysen and Bunker, 1924]. It was realised, however, that Trotman and Sutton might have been using strains of these organisms in their experiments which, for some reason or other, possessed special properties. An endeavour was therefore made to obtain subcultures from the original strains used by Trotman and Sutton. This was finally made possible through the kind offices of the curator of the National Collection of Type Cultures, Lister Institute.

With these cultures three series of experiments were carried out for the study of their action on cellulose. The series were planned to observe any changes occurring, as follows:

- (1) a visible resolution of the cellulose such as takes place when the carbohydrate is decomposed under aerobic conditions;
- (2) changes in the appearance under the microscope of the exposed fibres or hairs;
- (3) losses in weight of the exposed samples of cellulose.

For the purpose of the first series of experiments the strains were inoculated into a sterile nutrient solution¹ contained in test tubes in which strips of filter paper were partly submerged.

¹ The nutrient solution had the following composition:

Dipotassium hydrogen phosphate	...	...	...	0.1 %
Ammonium sulphate	...	...	...	0.2 %
Magnesium sulphate	...	...	...	0.1 %
Sodium chloride	...	...	...	0.1 %
Peptone	...	...	...	0.1 %
Manganese sulphate	} one drop each of a 1 % solution per litre			
Ferric chloride				

In the second series the fibres of the exposed filter paper as well as exposed cotton hairs were examined microscopically by the swelling test.

In the third series weighed quantities of filter paper contained in a nutrient solution, the whole having been previously sterilised, were inoculated with cultures of the test organism. The loss in weight of the filter paper was determined quantitatively at the end of the experiment.

In the first series the inoculated test tubes were incubated at 37°, in some cases for as long as 55 days. Though a vigorous development of the test organisms took place, the strips of filter paper showed no signs of destruction or disintegration except in two cases, when, after 21 days' exposure, the inoculated paper disintegrated at the place where it emerged from the solution. Attempts to reproduce this phenomenon in subcultures using part of the disintegrated paper as inoculant failed completely though the subcultures were incubated for 30 days or more.

It is interesting to note that the disintegrated fibres examined by the swelling test were absolutely normal, that is, could not be distinguished in any way from normal fibres.

In the second series of experiments, in which samples of filter paper and cotton hairs were examined by the swelling test after exposure for 55 days to the action of *B. subtilis* and *B. mesentericus* the exposed fibres and hairs were in all cases perfectly normal, showing no signs whatsoever of microbiological decay.

In the third series eight flasks containing weighed quantities of filter paper damped with nutrient solution were sterilised. Two of these flasks were left uninoculated to serve as controls. Of the remaining six, three were inoculated with a culture of *B. subtilis*, three with one of *B. mesentericus*. All the eight flasks were incubated at 37° for 28 days.

At the end of this time the filter paper in each flask was washed with hot distilled water, with a 1 % hydrochloric acid solution to remove any calcium carbonate present and again with hot distilled water. After drying, the various samples of paper were weighed. The data relating to these weighings are given in Table I.

Table I.

Flask no.	Inoculant	Weight of paper		Loss of weight %
		Before (g.)	After (g.)	
1	None (control)	12.7999	12.7191	0.63
2	"	13.8102	13.7603	0.36
3	<i>B. subtilis</i>	13.5961	13.4668	0.95
4	"	12.5762	12.5520	0.19
5	"	12.5059	12.1979	2.46
6	<i>B. mesentericus</i>	12.3832	12.3514	0.26
7	"	11.1551	11.1832	0.25
8	"	13.8918	13.5595	2.39

In only two cases—samples 5 and 8—was there a noticeable decrease in the weight of the filter paper after exposure beyond that observed in the control samples. But even here the loss in weight can hardly be claimed to

have passed the limit of accidental experimental errors. To assume that the loss recorded indicates a destruction of the cellulose by the test cultures is entirely unjustified. Had these types been capable of decomposing cellulose it is extremely unlikely that the destruction would have been limited to an occasional removal of 2 % of the total quantity available.

CONCLUSIONS.

The three series of experiments reported on in the preceding pages confirm the now generally accepted view that neither B. subtilis nor B. mesentericus is capable of decomposing cellulose.

The above experiments arose from work carried out on behalf of the Fabrics Co-ordinating Research Committee of the Department of Scientific and Industrial Research. The authors desire to express their thanks to the Department of Scientific and Industrial Research and to the Admiralty for permission to publish the results obtained.

REFERENCES.

- Thaysen and Bunker (1924). Notes on the action of *B. subtilis* and *B. mesentericus* on cotton hairs.
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