

none of those (11) emerging from the cocoons contracted the fungous disease. After 21 days no more adults emerged, although 13 cocoons remained, which I had evidence to believe contained living adults. Of these, nine eventually developed the typical *Isaria* and the moss also began to be covered with numerous *Isaria* colonies. This experiment confirms my other observations and also indicates that the disease may be artificially introduced even at so late a stage in the development of the larch sawfly. Infection takes place in nature, no doubt, much earlier."

"Although none of my experiments were made under strictly natural conditions, that is to say in the open air, yet the observation that the fungus *Isaria* is regularly found year after year under larch trees when once it has been found, may indicate that the results obtained really closely show what takes place in nature."

The above results and observations are confirmatory of my belief and observations as to the method of infection. They also indicate that the fungus is an important factor in the control of the disease, which is supported by my own and Mr. Mangan's observations under forest conditions. In certain cases the number of cocoons attacked has been as high as twenty-five per cent. Such a percentage of infection was observed by me in one locality in Cumberland in January, 1912. While this fungus is important practically, its widespread character would render the value of artificial distribution questionable.

## PREVENTIVE REMEDIAL MEASURES.

The adoption of any practicable measures against a pest of the nature of the larch sawfly when it is widely spread and native to the country, is a matter of very great difficulty. There are, however, certain measures of prevention and control which this investigation and other work resulting from it have indicated to be of value.

### PREVENTIVE MEASURES.

The most important measure is to keep a very careful watch on larch plantations or forests for the first signs of defoliation by the caterpillars. When twigs are seen stripped of their foliage a close inspection should be made for the presence of the characteristic larvæ or their green excrement "pellets" which can often be found when the larvæ are beyond reach or sight. It may be possible to control or eradicate the pest in its earlier stages when a few trees only are attacked.

*Planting.* In replanting or afforesting areas pure stands of larch should be avoided if possible. It has been observed that pure stands of larch are injured most by the depredations of the larvæ. In my first Report to the Manchester Corporation Waterworks Committee (August 1907) the following suggestion was made:—"In order to minimise the attack of the larch *Chermes* which is often a source of trouble to larch and spruce, I would suggest that in future the trees be planted in belts as far as possible rather than in a mixed manner, alternating larch and spruce with a belt of hard wood. This would lessen the risk of all the larches in a plantation being attacked by any pest similar to the one under consideration. If larch and spruce were divided by a belt of hardwood they would be less likely to suffer from the attacks of the injurious *Chermes*. This method of planting trees in belts has also the advantage of preventing, to a great extent, the spread of fire should it break out." As a result of subsequent recommendations of Dr. Fisher the Manchester Corporation are not planting pure larch but mixtures. Annand (1910) makes similar suggestions with regard to avoiding the formation of pure larch plantations and the planting of isolation belts. He also recommends the underplanting of young plantations of pure larch with shade-enduring species to check the growth of mosses and grasses indispensable to the safety of the cocoons.