

# FURTHER OBSERVATIONS ON THE OIL SPOT DISEASE OF TEA

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## Introduction

Oil Spot Disease of tea was first observed in an up-country estate in 1955, but was not brought to our notice until two years later. In 1959, (Mulder and Shanmuganathan, 1959), we described in detail the symptoms of the disease, discussed its occurrence and distribution, and also put forward some hypotheses as starting points for investigations into the cause, which was then unknown.

This paper summarises briefly some of the new observations which we have made since then, and also provides some evidence that a fungus causes Oil Spot Disease.

## New Observations and Possible Cause

Recent observations suggest that the symptoms of the disease are variable according to the age of the tea bush from pruning. The first symptoms appear 2-3 months after pruning on the older leaves of the newly developing shoots; large areas of these leaves, and sometimes the entire leaf, appear dark brown to grey, and oily, and the affected leaves fall off prematurely (Fig. 1). More characteristic oil spots, consisting of translucent spots surrounded by a halo, appear later on the younger leaves and these too fall off subsequently resulting in complete defoliation of the young branches. In some cases, intense necrosis of the main veins is also evident.

New leaves developing on the affected branches are often considerably deformed. The commonest symptom is a backward arching of the leaves accompanied by an inward folding of the leaf blade, resembling to some extent the symptoms of Phloem Necrosis Disease. Very often the growth of lateral buds is stimulated and a type of "witches' broom" develops.

A symptom noticed very recently is a browning of the outer wood of young branches, indicating damage to stem tissues as well as to leaves. This is easily observed if the bark is peeled off from a diseased branch when the wood below is seen covered with brown streaks. The occurrence of the disease is still restricted to a rather small number of up-country estates situated, with one exception, at elevations between 5,000 and 7,000 feet. So far, we have observed the disease on only eight estates (*i.e.* one more than reported previously) in the Dimbula, Nuwara Eliya and Uda Pussellawa Districts.

The cause of the disease has for a long time remained obscure as all efforts to isolate a pathogen from diseased shoots have proved unsuccessful, and all attempts to transmit the disease by sap inoculations and grafting also failed. Roots of infected plants always appeared healthy, and there was very little or nothing to suspect in the soil. By 1962 it became clear that the cause was not localized in the young shoots and that the disease agent was probably hidden in the frame. Working on this hypothesis the frames of a large number of diseased bushes were dissected and examined carefully. This revealed that in all diseased bushes a portion of the collar

of a main branch below the affected shoots appeared discolored and rotten, suggesting the presence of a wood-destroying fungus. Attempts were then made to isolate a fungus from the edges of this decomposing wood. The same organism appeared consistently, and was isolated from diseased material collected from several different estates.

At the same time discs were cut from the frames and placed under humid conditions in polythene bags. In most of the discs examined the same fungus grew out from the border of the diseased sector and over the healthy wood (Fig. 2).

It thus appeared that diseased bushes invariably contained a wood-rotting fungus in some part of their frame or branches and that this fungus was probably responsible for the symptoms found on young shoots. Experiments were then undertaken to verify this point.

The fungus was grown in an artificial liquid medium containing sugar for 3 weeks at room temperature (23°C). At the end of this period, it had formed a thick mat; the liquid was filtered off and rooted cuttings of tea were grown in the filtrate. Characteristic oil spots and necrosis of the veins occurred after 4 days (Fig. 3). Cuttings placed in the original pure culture remained free from symptoms. The experiment was repeated several times and the same result was obtained on every occasion.

When young bean plants were placed in the same culture filtrate water-soaked spots developed on the leaves and browning of the vascular tissues occurred. Excised tomato shoots showed rapid wilting followed by death of the leaves.

These experiments indicate that the fungus isolated from bushes showing Oil Spot Disease produces a toxic substance in culture, which passes into the leaves and causes there the symptoms in question.

Experiments were also carried out to determine whether the toxin is also produced in the diseased plant. Diseased wood was macerated thoroughly, extracted with distilled water, and rooted cuttings placed in the filtrate. Oil spots appeared on the leaves after 4-5 days. Extracts from healthy wood were found to be non-toxic.

These experiments by themselves do not yield absolute proof that the fungus isolated causes Oil Spot Disease of tea. Clearly, more work is needed to prove this conclusively. Firstly, the fungus will have to be inoculated into healthy tea bushes and the symptoms reproduced, but this will only establish the causal relationship between the growth of the fungus in the frame and the appearance of oil spots on the leaves. Secondly, to establish the role of the toxin in the disease, it will be necessary to isolate the substance in a reasonably pure form, reintroduce it into the plant, and reproduce at least a portion of the disease symptoms. This procedure is very often not easy because in most cases these substances are produced in extremely small quantities so that it is not possible to isolate them, and, moreover, some of them are very unstable.

As regards the first point, several healthy tea bushes have been inoculated with the fungus, but no symptoms are forthcoming yet. It is possible that this will take some years in view of the slow growth of the fungus.

With regard to the second point, although we have not been able to isolate the toxin from diseased plants or culture filtrates, the lesions produced from the crude extracts are so characteristic that it seems very likely that the toxin produced by the fungus in the host plant is the same as that in the culture filtrate.



Figure 1. Leaves from young branches showing various degrees of Oil Spot symptoms.

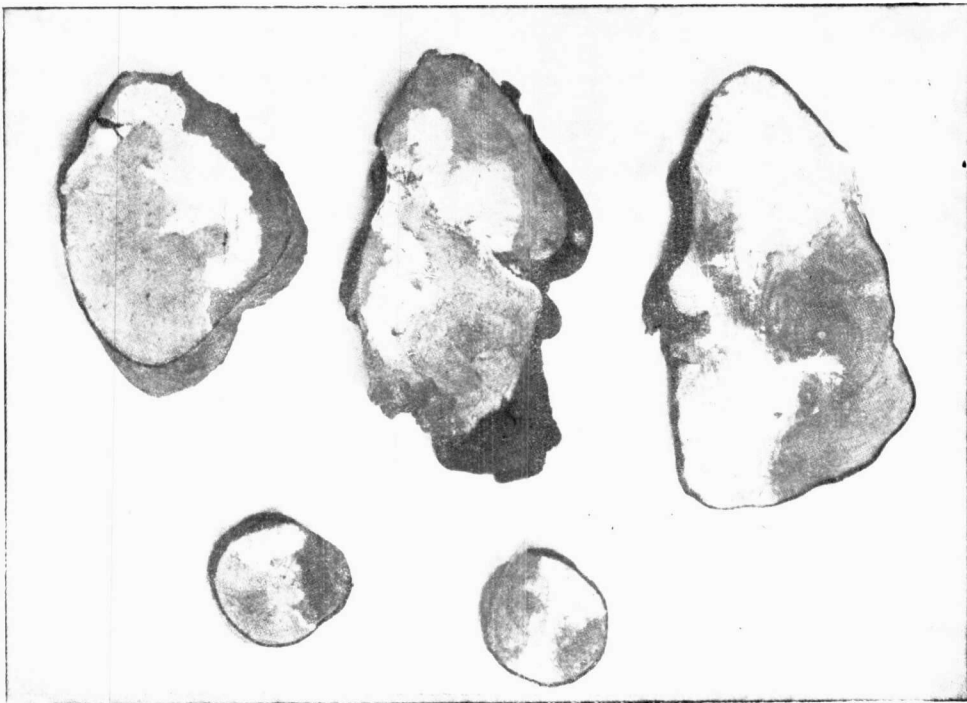


Figure 2. Discs from frame of diseased plant showing fungus growing out from the edge of rotting wood.

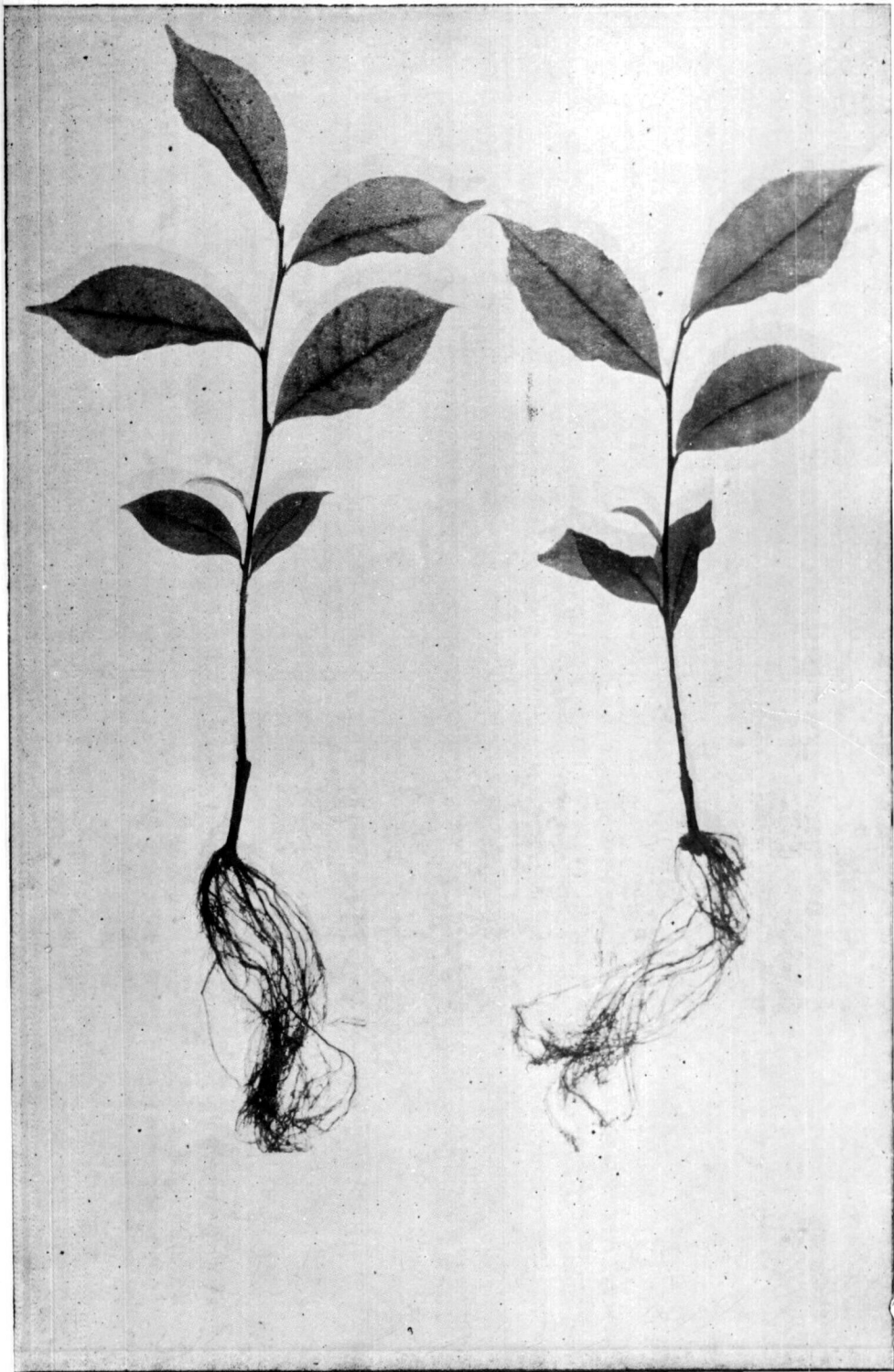


Figure 3. Left: rooted cutting after 5 days in culture filtrate; note oil spots and necrosis of veins.  
Right: cutting placed in pure culture, free from symptoms.

## **Identity of the fungus**

The fungus has so far remained sterile on several culture media, and no fruiting bodies have been observed on infected tea bushes. It has therefore not been possible to identify it.

The cultural characteristics resemble those of a certain *Xylaria* sp., but there is no record of such a fungus infecting tea stumps.

## **Practical Implications and Control**

The practical importance of this disease does not appear to be very great since only a small number of affected bushes have been found on a few estates. It is not possible to say whether the disease will ever assume more serious proportions and, if so, when. The potential danger is, of course, there and it is therefore necessary that we should know something about the mode of spread of the disease. This information is lacking now because no spore-production has yet been discovered.

Spread by air-borne spores from fruiting bodies occurring on jungle and shade trees is one possibility, if we assume that these trees are also attacked by the same fungus, but this has not been observed. It should, however, be mentioned that many of the tea fields showing the disease are situated near the jungle.

Regarding the control of the disease, very little can be done apart from uprooting and burning diseased bushes. Fungicides applied as sprays are unlikely to be of much use as these cannot reach the fungus which is embedded in the tissue. Since the pathogen appears to be a wound parasite or a weak parasite that probably grows first saprophytically on dead wood before gaining entry into live material, it may be possible in some instances to cut out the diseased part of affected bushes, and treat the cuts with a fungicidal paint. This treatment may not be feasible in cases where the fungus has grown deeply into the collar; here, it is difficult to say whether the bush will survive a hard, collar prune.

It is possible that in the next few years more bushes may show the disease in fields where the disease has already been noticed. This would only imply that a number of bushes which were infected probably years ago have now reached the stage when symptoms begin to show.

One factor contributing to the occurrence of this disease may be the hard pruning practised in the past. In a large number of cases we have observed that diseased bushes had been hard pruned previously, leaving big open wounds near the collar. Such wounds take a long time to heal and provide excellent avenues for infection by wound parasites. If this had indeed been the way in which this fungus had gained entry into the frame, we should take this as a warning and treat bushes more kindly in future. It is always undesirable from a pathological point of view to cut away big branches from the frame; we believe that once a frame has been established it should stay as it is, provided of course that the branches remain healthy.

Another possible contributory factor is sun scorch of the frame immediately after pruning, but this is rarely serious at elevations where Oil Spot is found.

The risk of new clearings getting infected is, as far as we can judge, very small. Oil Spot has never been found in young clonal tea; it always occurs in old seedling tea, which had suffered repeatedly from hard pruning, sun scorch and wood-rot. It is difficult to say whether old clonal tea would likewise be affected.

## **Summary**

Some new observations made recently on the Oil Spot Disease of tea are reported. The most striking of these is the constant association of a weak, parasitic fungus with this disease. There is strong circumstantial evidence to suggest that this fungus produces a toxin which acts at a distance from the site of infection, and gradually destroys the entire plant. Some practical implications of the disease are discussed in the light of this new finding.

## **Reference**

MULDER, D. and SHANMUGANATHAN, N., (1959). Oil Spot of tea leaves—a new disease? *Tea Quart.*, 30, 44.