THE COLLECTION OF BLISTERED LEAVES

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The Blister Blight disease of tea gets its name from the presence of white blisters, which resemble circular pieces of dough adhering to the under-surface of affected leaves. The white tissue is the fungus *Exobasidium vexans* which causes the disease. Spores are produced on its surface in large numbers. They are microscopic, and when ripe, are carried large distances by air currents. It is possible that the disease arrived in Ceylon as spores carried through the air from South India, though no proof of it can be offered, but it is undoubted that the disease was rapidly distributed through the tea areas of Ceylon, even to Uva, by air currents.

Where the spores will fall is entirely a matter of chance. Only those which find lodgment on the under surface of young tea leaves or on very young stems have any chance of survival, and then only if climatic conditions are favourable for their growth. It will be realised that only a small fraction of the spores produced can possibly survive, yet sufficient do survive to cause a very large number of infections in the tea fields. When the leaf surface is

wet with dew or rain, spores adhering to it begin to grow. A small tube or thread (hypha) grows out from the spore and enters the leaf through one of the pores (stomata) on its under-surface. There are very few (if any) stomata on the upper-surface of the tea leaf and, consequently, spores on the upper-surface rarely cause infection. Once the hypha has entered the leaf the fungus is safe and well protected from adverse climatic conditions, such as dryness; it continues to grow and branch, but entirely within the leaf. The area invaded by a germinated spore is limited to the circle which later becomes the blister. For some days there is no visible evidence that a leaf has been invaded, and usually, about three weeks elapse before a white blister is fully formed. The period of three weeks is of course only approximate; it may be shorter or longer depending on external conditions; humidity and temperature being of greatest importance. For the greater part of the period, however, there is no very obvious sign that the leaf has been infected.

Now let us assume that the first blister has been observed in a tea nursery today and we decide to spray in order to protect the young plants. Before starting operations let us consider what the occurrence of that one blister means. First, it is certain that spores were passing through the nursery about 3 weeks ago, and probably others have passed into it daily ever since. How many of those spores have lodged on the leaves and how many have germinated and caused infection we do not know, but we shall certainly learn during the coming three weeks. If during the previous three weeks climatic conditions have been favourable for the germination of the spores a large number of plants are already infected.

At this stage we can spray the plants, coating them carefully and thoroughly with a fungicide, realising perhaps that the work might have been more beneficial had it been done three weeks earlier. What benefit is likely to be derived from the spraying? Surely we have protected the existing tisues against further infections. Newly arriving spores will be killed by the poison before or after germination, and before the hyphae can gain entrance into the leaves. Although the plants have been protected for a time against future infections, the spray can do nothing about the earlier ones. Sprays are not curative. Those leaves which were infected during the three weeks the first blister took to develop will ultimately all carry blisters just as though they had not been sprayed. If instead of spraying the whole nursery we spray only one half of it, we ought not to be surprised if during the next three weeks as many blisters occur in the sprayed area as in the unsprayed area of the nursery. Whether the spray has given beneficial effects or not must be decided from the blisters developing in the sprayed area about 3 weeks after spraying. During the three weeks after spraying the plants will have grown, *i.e.*, they will form new susceptible tissue, and perhaps the fungicide will have been washed off by rain, and so the plants will then no longer be protected completely. Spraying has, therefore, to be repeated at intervals to give complete protection.

Now let us suppose that instead of spraying the plants we decided to pluck and destroy the blistered leaves as they became evident. There will be the satisfaction that at least some of the fungus will be destroyed, and that the blisters we collect today will produce no more spores. During the next three weeks, however, blisters will occur in exactly the same numbers as if the plants had been sprayed. But in addition new infections will occur because the young leaves are not protected,

and, so, in consequence, more blisters will develop later. We are therefore justified in asking whether the collection of blisters can do any real good? To that question it is impossible to give a straight and exact answer. If no other blisters existed elsewhere outside the nursery, then collection would obviously be beneficial, but blistered leaves are far more numerous outside the nursery than within it, and the destruction of blistered leaves within the nursery can do nothing to stop spores coming in from outside. The collection of blistered leaves, however, is a matter to be considered in connection with tea in full plucking rather than with young plants in a nursery, so we may leave the nursery at this point with this conclusion: Blistered leaves should not be plucked in nurseries; spraying should be resorted to.

Turning now to infected tea in full plucking. The experience not only in Ceylon but everywhere the collection of blistered leaves has been attempted, is that whenever the disease takes epidemic form the collection of blistered leaves cannot keep pace with the production of blisters. That clearly indicates that under adverse conditions collection is useless. It may be worse than useless, as collection can do more damage than the disease itself.

Let us assume that a leaf carries one or more blisters which cover one-fifth of its area. Obviously, 20 per cent of the leaf is dead or dying *i.e.*, where the blisters are, but the remaining 80 per cent is green and carrying out its normal functions. It will be evident that by plucking that leaf one can do four times as much harm to the bush as the fungus has done via that leaf. As an extreme case, suppose every leaf on a bush is infected, the collection of all blistered leaves will mean the removal of every leaf except the few youngest in which the disease has not developed sufficiently far to be evident as blister. That stripping will certainly do more damage to that bush than the disease itself would do. By stripping, a certain amount of the fungus is destroyed which perhaps is a small advantage, but can that benefit outweigh the destruction of a large amount of healthy tissue? Surely the answer must be 'No.'

The collection of blistered leaves is somewhat similar to what was done in Ceylon some years ago, the collection of leaves carrying Tortrix egg masses. There is one big difference however. The white blister is more analogous to the female moth after she has started to lay eggs. The blister produces infinitely more spores than the Tortrix moth does eggs, and they are smaller, invisible to the naked eye and are dispersed through the air. After egg masses had been collected from a field few would be absolutely confident that none had been overlooked. After blister collection, one can be certain that a very large number of spores have not been collected. Mention has already been made of the fact that at times blisters are produced faster than the labour force can collect them. That was never the experience with Tortrix egg mass collection. This brief comparison serves to show that blister collection must be far less efficient as a method of control than the collection of Tortrix egg masses was.

We have seen that the tissues most susceptible to attack are the young leaves and stems, but evidence of their infection is not visible for sometime later till blisters are formed and spores are being produced. If the development of new blisters is to be prevented, it will be obvious that the best way to do it is by the removal of all young growth. That young growth is commonly known as 'flush' and is what is collected as harvest. By short plucking rounds and hard plucking, *i.e.*, plucking to the fish leaf,

it may be possible to prevent the full development of new blisters and so prevent production of spores. The life of a fully developed blister depends upon weather conditions ; it is shortest during hot dry weather. If the development of new blisters could be entirely inhibited, the death of all old blisters would result in the eradication of the disease. That would be perfection and is not likely to be achieved. But it will be evident that the removal of young leaf as rapidly as possible must very materially reduce the number of new blisters that can develop.

If we now compare the values of plucking and of collecting blisters there can be no doubt whatever that plucking is the more effective method of control. It is a waste of labour to collect blistered leaf when it can be more usefully employed plucking for harvest.

Hard plucking and short rounds do not result in immediate loss of crop. That fact has been proved conclusively by experiment. No doubt there are many disadvantages attached to such treatment if persisted with, but hard plucking is here recommended as a means of controlling blister blight, and not as a general practice. Normal plucking can be resumed during periods unfavourable for the dissemination of the disease.

When blister blight first appeared in Ceylon the Institute advised the collection of blisters in the hope that its rate of spread might be retarded. It soon became evident that collection could not keep pace with the formation of new blisters and the recommendation was withdrawn. If collection is of value at any time, it is when blisters are few and weather conditions are unfavourable for the fungus, but there must be some doubt even about that. Whatever one's opinion may be concerning the collection of blisters as the main method of direct attack on the fungus, there can be no doubt that where the bushes are in plucking, short rounds coupled with hard plucking are by far the best measure of control.