

AN EXPERIMENT ON THE CONTROL MAINTENANCE-LEAF FALL BY CERTAIN SANITARY MEASURES

N. Shanmuganathan and W. W. Redlich

Introduction

In the high rainfall conditions of the low-country the premature fall of maintenance-leaf is now regarded by some as one of the limiting factors in crop production. Recently Mulder (1961) drew attention to the importance of this problem to low-country tea estates by pointing out some of the consequences of maintenance-leaf fall. He argued that recurrent attacks can weaken the bushes considerably and deplete all reserves in the roots, thus leading to non-recovery after pruning.

The cause of maintenance-leaf fall is still obscure, although several factors are now thought to be responsible for it. Early workers like Petch (1923) and Gadd (1949) were of opinion that the fungus *Rhizoctonia solani* was the cause of the death of mature leaves in the low-country. On this assumption, Webster (1953-55) carried out experiments to control the disease by spraying, thatching and other treatments, but results were disappointing, and he concluded that *R. solani* was not the main cause of maintenance-leaf fall. Webster was unable to isolate *R. solani* from diseased leaves, but observed that the causative organisms of Brown Blight (*Colletotrichum camelliae*), Grey Blight (*Pestalozzia theae*), Red Rust (*Cephaleuros parasiticus*), Thread Blight (*Marasmius pulcher*) and Horse-hair Blight (*M. equicrinus*) were always associated with maintenance-leaf fall. He also suggested that the disease may be due to Shot-hole borer.

Mulder (1961) considered that potassium (K) deficiency was the initial cause leading to death and defoliation of maintenance-foliage and provided some data in support of this contention. He observed that the K content of leaves from affected estates was significantly low when compared with leaves from healthy estates.

It appears, therefore, that the causes of maintenance-leaf fall can be manifold. This paper deals with only one aspect of the problem, namely the part played by the various saprophytic and parasitic fungi that are found associated with the disease. In this experiment attempts were made to control these fungi by cleaning out after pruning, or by spraying.

Experiment (1961-63)

The experiment was conducted at Millakande Estate (128' elevation), Bulathsinhala, on old, seedling tea that had shown severe maintenance-leaf fall in the past. The tea was pruned lightly, as practised in the low-country, and the following treatments were applied:—

Treatments

1. Drenching spray of Zineb (Zinc ethylene bisdithiocarbamate) at monthly intervals at the rate of 12 oz. in 40 gallons of water per acre.
2. Zineb as in No. 1, first spray 10 months after pruning.
3. Drenching spray of Perenox at monthly intervals at the rate of 12 oz. in 40 gallons of water per acre.

4. Perenox as in No. 3, first spray 10 months after pruning.
5. After pruning, the frames were cleaned using a coir brush and the prunings were collected and destroyed.
6. Untreated control.

The treatments were randomized in contiguous plots of 200 bushes and were replicated five-fold. The sprays were applied with hand-operated knapsack machines.

Records

The amount of maintenance-leaf fall and the extent of fungal colonization on the experimental bushes were assessed periodically by assigning ratings based on visual observations. These assessments were made monthly on 10 bushes selected at random from each plot. Ten such assessments were made before the experiment was concluded.

During the last 5 months of the experiment, the method of assessment was improved to obtain a direct measure of the leaf fall, this being achieved by placing traps under the bushes and weighing the fallen leaves monthly. The leaf fall from 2 bushes in each plot was determined.

At the conclusion of the experiment (after 2 years) the tea was pruned and prunings taken from 10 bushes in each plot were weighed.

Yield records were maintained throughout the experiment.

Results

The results are summarized in Table 1 as mean values for the various assessments. It is clear from the results that there was a significant reduction in maintenance-leaf fall in the treated plots when compared with the untreated. This finding is supported by visual observations as well as by direct measurements of the actual leaf fall. There was also a significant reduction in the extent of fungal colonization on the treated bushes. However, there was no significant difference in the crop harvested from the sprayed or cleaned plots, and the untreated control plots.

TABLE 1.—*The Control of Maintenance-Leaf Fall by sprays*
Mean value of assessments

<i>Maintenance-Leaf Fall</i>	Treated	Untreated	Significant Difference
(a) Ratings (10)	11.7	15.9	3.5; P < 0.01
(b) Dry weight (gm.) of leaf-fall from 10 bushes/plot (5)	10.42	12.38	1.95; P < 0.001
(c) Fresh weight (lb.) of prunings from 10 bushes/plot	48.60	46.50	Not significant
<i>Saprophytic fungi</i>			
(d) Ratings (10)	10.7	14.2	2.4; P < 0.05
<i>Yield</i>			
(e) Green leaf (lb.) (85 pluckings)	28.11	28.61	Not significant

(Figures within brackets indicate No. of assessments carried out)

The treatments did not differ significantly among themselves in any respect, thus showing that the spray treatments were as good as cleaning bushes after pruning.

Discussion

On several occasions during the course of the experiment diseased material collected from the experimental plots was brought to the laboratory and the fungi present in it isolated. These isolations revealed consistently the presence in the dead leaves of the fungi causing Horse-hair, Thread, Brown and Grey Blights and *Botryodiplodia theobromae*, a fungus that is known to attack only weak or moribund tissues. Red Rust was frequently observed, but it was not possible to isolate *R. solani* or any other parasitic fungi at anytime during the experiment. It is, therefore, clear that *R. solani* is not the causative agent of maintenance-leaf fall, and this confirms Webster's observations.

All treated plots showed considerably less fungal colonization than the untreated controls, thus indicating that by regular spraying, or by cleaning out after pruning, the saprophytic and the weakly parasitic fungi can be controlled successfully. The sprayed plots also showed markedly less infection by Red Rust, this being most evident on the Perenox-treated plots. There was no evidence of Shot-hole borer on any of the plots.

The control of the "Blight" fungi was never 100% on any of the treated plots probably because the sprays were weak (0.18%) and the cleaned plots re-infected. Nevertheless, the treatments were good enough to effect significant reduction in maintenance-leaf fall, and this clearly suggests some relationship between the Blight fungi and maintenance-leaf fall. Although Petch (1923) and Gadd (1949) maintain that both Horse-hair and Thread Blights are harmless to the tea bush, the evidence from this experiment does not conform to that view. It appears that these fungi are in some manner contributing towards the premature fall of the maintenance-leaf, even if they are not fully responsible for it. The effect of these fungi may be solely physical, brought about by the smothering of the leaf by the thick mycelium.

The control of maintenance-leaf fall was only partial even in those plots where the fungi were controlled successfully, indicating that there are probably other factors involved in the disease, such as self-shading and nutrition. The disease is serious only in tea that is nearly due for pruning, when the bushes are overgrown and the lower leaves heavily shaded. In these circumstances, combined with the hot and humid conditions prevailing in the low-country, it is possible that lower leaves become redundant physiologically and are shed. This may be an entirely natural phenomenon! If that is true, one wonders whether such leaf-fall can be arrested at all, and if so, of what use is it? The obvious question arising is: "Is the so-called maintenance-leaf really maintaining the bush?"

On the other hand, it is also possible that these leaves, although redundant, may stay longer on the bush, if not invaded by the Blight fungi. In that case, the fungi are a blessing in disguise in that they promote the loss of unproductive leaf.

The failure to obtain more crop from the treated plots could be due to inadequate control of maintenance-leaf fall, or it may be that the beneficial effects of the treatments in terms of increased crop can only be realized after several years. It seems more likely, however, that in the exceptionally humid and shady conditions prevailing, the leaves in question do not serve any useful function. The fact that neither the crop nor the weight of prunings obtained from the treated and untreated plots differed substantially lends support to this hypothesis.

Though this experiment is only a preliminary one, it still provides some evidence that maintenance-leaf fall can be checked at least partially by adopting certain sanitary measures. This can be achieved in two ways, namely by cleaning out after pruning, or by spray applications during the latter part of the pruning cycle. It is suggested that cleaning the frames and destruction of prunings be adopted as a routine measure at every prune on estates which suffer from maintenance-leaf fall. Prunings should be collected and burnt wherever possible, and the frames painted with limbox or any other preparation containing lime and sulphur. If thick mycelium is present on the stems, it may be advisable to brush the frames with coir or other suitable material prior to application of limbox. Estates which are unable to perform the above cleaning operations can instead apply 2 or 3 drenching sprays of copper or Zineb at a concentration of 1 lb. in 40 gallons of water (0.25%) at fortnightly intervals. If it is not possible to carry out either of these treatments at pruning time, it is recommended that a monthly spray be given with the same chemical during the last 6 months of the pruning cycle.

Clearly further investigations are necessary to answer the many questions raised in this paper, and in this connection we are glad to say that experiments are already in progress to ascertain the role of shade and nutrition in maintenance-leaf fall, and the usefulness of the lower canopy of leaves in bush maintenance.

Summary

This paper describes briefly an experiment carried out on the control of maintenance-leaf fall by certain sanitary measures. Field observations and laboratory investigations confirmed the constant association of the disease with the fungi causing Horse-hair, Thread, Grey and Brown Blights. There was no evidence of any connection between the disease and *Rhizoctonia solani* or other parasitic fungi. Cleaning bushes after pruning followed by destruction of prunings resulted in significantly less fungal colonization and less maintenance-leaf fall, but without any increase in yield. Similar results were obtained by spraying bushes in the latter half of the pruning cycle with either Perenox or Zineb at the rate of 12 oz. in 40 gallons of water per acre. It is recommended that bushes be cleaned out at every prune on estates which suffer from maintenance-leaf fall.

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