

A LEAF-FALL DISEASE OF GREVILLEAS

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A disease of *Grevillea* trees, characterised by premature falling of the leaves, has occurred this year in some of the low-country districts of Ceylon. It was first observed in the Peimadulla district in a mild form in December last, but at the beginning of February it suddenly occurred through a large estate in the course of three or four days, during which time it was estimated that 85 per cent of the trees became infected. In the same month the disease appeared on certain estates east of Galle, and it has since been reported from Balangoda, Opanaika, Ratnapura, Kiriella, Dehiowita and Yatiyantota.

Many estate managers when reporting the occurrence of this disease have commented on its resemblance to the leaf-fall of rubber caused by *Oidium heveae*. This resemblance has been remarked upon mainly because the disease of *Grevilleas* has occurred in districts where *Oidium* leaf-fall of rubber is well known, and because the two diseases have occurred at the same time and almost side by side. Also, in 1925, when *Oidium* first occurred on rubber in Ceylon, its rapid spread through the districts, in which it has since become endemic, was very similar in many respects to the spread of this disease amongst *Grevilleas* this year. There is, however, no direct connection between the two diseases. No trace of *Oidium* has been found on the affected *Grevilleas*, nor does the distribution of the *Grevillea* disease correspond closely with that of *Oidium* of rubber. For instance, *Oidium* is common in the mid-country yet the disease has not occurred on *Grevilleas* in those localities.

The localities in which leaf-fall of *Grevillea* has been reported are mainly below 1,000 feet. The highest elevation at which the disease has occurred is about 1,600 feet. At the latter elevation the attack lasted only about one month when young shoots, near the top of the trees only, shed their leaves.

At lower elevations the disease has been more serious, as defoliation has continued since its onset in February until the time of writing (July). At the beginning of July the affected trees carried no fully grown foliage, but, unless dead, bore numerous tufts of young and half grown leaves on the growing shoots. On the ground below the trees were to be seen numerous immature leaves, and on shaking the trees a fairly heavy fall of young leaves resulted. The freshly fallen leaves were green and appeared healthy except for

one or more black spots; very young leaves being shrivelled, curled and often blackened at the edges. The dead areas or spots were irregular in shape and varied in size. In some cases, only one lesion occurred on the leaf and that usually did not exceed $\frac{1}{4}$ -inch in diameter. On other leaves the spots were more numerous and larger. In general, however, the dead areas of the fallen leaves were relatively so small when compared with the apparently healthy areas that it seemed somewhat incredible that defoliation should result.

One of the earliest reports stated that this disease had appeared after heavy rains following a drought, and that trees of all ages were affected. The climate this year has not been remarkably abnormal, and Grevilleas have been grown in the affected area for a number of years; one estate had used Grevillea shade since 1912 without previous occurrence of this disease yet was severely attacked this year. The widespread and continued incidence of this disease clearly indicates that it is not solely the result of adverse climatic conditions though possibly the somewhat heavier rainfall, higher temperatures and humidity than normal during February favoured the epidemic.

During the five months following the onset of the disease several estates have reported three defoliations. These defoliations were in no case complete in the sense that the trees were denuded of leaves at all stages of growth at any one time. More correctly it may be stated that there were three defoliation periods though it is not possible to define clearly these periods and correlate them with climatic conditions, as when one field was being defoliated another on the same estate appeared to be recovering and showed no recent fall. It is probable, however, that wet weather favours the disease as in several instances severe defoliation has coincided with rains, and that the absence of prolonged periods of fine weather has contributed to the continuance of the defoliation. The attack on one estate situated in the dry zone started during wet weather and ceased a month later when dry weather set in.

The disease, like oidium leaf-fall of rubber, is one which primarily affects young leaf. When, however, the attack is particularly severe older leaf may also be shed. One estate which has experienced three defoliations reports that the disease affected young leaves only, except at the third defoliation, which was most severe, when quite a lot of old leaf was also shed. At the end of July the affected trees on several estates carried no mature foliage. It will be recognised that continued defoliation particularly in the absence of mature leaves can have only one, and that, a fatal result. The number of deaths in July was steadily increasing.

Amongst the diseased trees were to be found occasional trees which showed no indication of leaf-fall at all, and their freedom from disease suggests a possibility of immunity. It would be advisable to keep such trees under observation to ascertain whether they remain free from disease, as if they set seed and their progeny also prove resistant. Seed from such trees may prove valuable for supply purposes. On one estate the unattacked trees were stated to have been raised from Australian seed; another estate planted 6 years ago with Australian seed was very severely affected. It is unlikely, therefore, that the resistant plants can be traced back to seed of a particular source.

Reference has already been made to the fact that the disease has not been recorded above 1,600 feet elevation. It would appear probable that elevation, or the climatic factors associated with elevation, such as temperature, may limit the distribution of this disease. There are, however, certain fields, and may be estates, below 1,000 feet which have escaped attack, for which no satisfactory reason can be ascribed at present. It will be interesting to learn whether they continue to be unaffected in later years should the disease recur. Some of the unattacked areas are contiguous with diseased areas and though in some cases the elevation is higher, the difference is not sufficient to account for the freedom from attack. One instance may be cited to illustrate some of the peculiarities of distribution. A nursery situated at 600 feet above sea level was badly attacked during March and April, but later recovered rapidly. This nursery was surrounded by mature *Grevilleas* generally free from the disease except for those situated in hollows and confined spaces.

The evidence available indicates that the cause of the disease is a pathogenic fungus. As already stated no trace of an *Oidium* has been found on any of the numerous specimens which have been examined, which should allay any suspicion that the leaf-fall of *Hevea* and *Grevillea* have a common causation. There is, however, one fungus which has been found consistently on all specimens from different estates. This has provisionally been identified as a species of *Phyllosticta* which is a genus of fungi commonly associated with leaf spots. Other fungi have also been isolated from diseased leaves but not with the regularity that the *Phyllosticta* has been obtained. These belong principally to the genera *Colletotrichum* and *Pestalozzia* both of which include numerous species which attack leaves. Inoculation experiments on young *Grevillea* leaves in the laboratory have shown that of the several fungi isolated the *Phyllosticta* alone has proved capable of infecting the *Grevillea* leaves, even when the fungi are introduced through wounds.

The constant association of the fungus with the diseased condition, and the fact that experiment has shown that the fungus is capable of infecting *Grevillea* leaves under certain conditions, afford *prima facie* evidence that the *Phyllosticta* is possibly the cause of the disease. Another interesting point has been observed during the laboratory experiments, viz. that although the cultures of the *Phyllosticta* do not fruit at room temperature ($20^{\circ}\text{C.} = 68^{\circ}\text{F.}$) spores were produced abundantly when the cultures were placed in an incubator at 32°C. ($89\text{--}90^{\circ}\text{F.}$). Much importance cannot be attached to this observation at present, though it may afford a clue to the distribution of the disease being limited to the lowest elevations.

The occurrence of this disease amongst *Grevilleas* in the low-lying tea districts raises still another problem for the planter. *Grevilleas* are grown for their shade and mulch, and it is doubtful whether heavy expenditure on disease prevention would prove economical, especially as other trees might well take their place. Prevention of a leaf disease such as this entails spraying or dusting with fungicides on lines similar to those adopted against the leaf-fall of *Hevea*. Sulphur-dusting of *Grevilleas* would undoubtedly result in a depreciation of the value of the tea crop resulting from taints, and the use of other fungicides is likely to have similar or other ill-effects. Estates are, therefore, not inclined to undertake such operations without assurance that they are likely to be economic.

It will be realised that if the leaf-fall symptom of this disease is caused by a parasitic fungus, as is here suggested, and is not the direct consequence of somewhat unusual climatic conditions which cannot be defined, it is likely to recur whenever climatic conditions are favourable for the fungus. The complete eradication of a disease of this type is at present quite impossible. The only practical measures are preventive and as these may have to be repeated at intervals, the cost becomes recurrent. Time alone can show whether the disease will remain persistent, become annually recurrent, or disappear. General spraying treatment cannot, therefore, be recommended though small-scale experiments to determine the efficiency of such treatment may afford valuable information concerning the practicability and economics of such measures.

It is hoped that the managers of all estates on which this disease has occurred will periodically acquaint the Tea Research Institute of its progress. Such reports are of the greatest value in helping to arrive at a better knowledge of the disease and the factors which affect it.