

VIRUS AND VIRUS-LIKE SYMPTOMS ON SEEDLING TEA

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Unlike clonal tea, mature seedling bushes show a great variety of leaf discolourations and deformations. Gadd (1948) described two of these disorders under the names 'non-infectious variegation' and 'infectious chlorosis'. I previously mentioned a series of these troubles in the Annual Report for 1958 (Mulder, 1959).

Due to variation in the reaction of different tea seedlings to the same disease, the number of different symptoms may be larger than the actual number of disease agents present, and when more results of virus transmissions become available the number of names of diseases may be less. For the present the following symptoms can be considered as expressions of distinct diseases or abnormalities.

In general, patterns of discolourations in leaves can be:

- A. genetically conditioned in the seed;
- B. due to mutation in the bud;
- C. due to a virus disease;
- D. physiologically conditioned by mineral nutrition or climatic factor (light, temperature);
- E. due to a parasitic organism.

The first group of genetically-fixed patterns of discolouration consists of—

1. non-infections variegation (Gadd, 1948);
2. speckled leaf.

1. The *non-infectious variegation* named by Gadd is a fairly common occurrence on up-country estates. This abnormality is most probably a genetically-fixed type and consists in its weakest form of a narrow yellow margin around the leaf (Fig. 1C). If fully developed, the leaf is almost completely yellow (Fig. 1A). The leaf pattern is invariably found all over a bush, which indicates that the bush has had this characteristic from the seedling stage as a genetic characteristic.

No branch on such a bush has ever been seen free of the symptom or has reverted back to normal green leaves.

2. The other rather common leaf symptom is a fine speckle. Three types have been found, namely, a whitish speckle, a yellow speckle and a red speckle. We are inclined to take the three together and consider them colour variations resulting specifically from one genetic abnormality in the different types of seedlings (Fig. 2). These speckled leaves always occur over one whole bush and we therefore assume that they are genetically fixed.

3. A third type of abnormality is restricted to one branch on the bush and is most likely a bud mutation. It is characterized by a white margin along the leaf and a silvery appearance of the leaf on both the upper and under side (Fig. 3). This condition is caused by the fact that apart from the epidermis (of which usually only the stomatal cells contain chlorophyll) at least one layer of cells without chlorophyll surrounds the chlorophyll-containing cells of the parenchyma,

4. Another type of bud mutation results in leaves that lack the green pigment in an outer layer of the leaf but have preserved the yellow pigment with the result that the leaves are surrounded by a yellow border (Fig. 4). The remarkable thing in this case is that older leaves do not show this characteristic. Only two bushes of this kind have been found.

5. Several other types of bud mutation are found. Sometimes the disappearance of chlorophyll is almost complete and the leaf is practically white (Fig. 5). Such shoots can only exist by getting food through the phloem from other (green) branches.

6. The *infectious variegation* of Gadd (1948) is here re-named "white-streak mosaic" to bring it in line with modern nomenclature of virus diseases (Fig. 6). This condition has not spread in any noticeable way and is still extremely rare. It is characterised by occurrence on one branch of a bush. The symptom can even be restricted to one side of a shoot, with the result that several leaves show the mosaic only on one half.

7. Apart from "white-streak mosaic", a number of bushes have been found showing a "yellow-streak mosaic". Both white-streak and yellow-streak mosaic are accompanied by considerable leaf deformation (Fig. 7).

8. "Crinkle-leaf" is a condition of the leaf in which yellowish parts show less growth and cause considerable leaf contraction and bulging. This is most likely a virus disease (Fig. 8).

9. Many virus diseases are characterized by an "oak-leaf" pattern in the leaf which exists as a yellow band at some distance from the major veins. A number of seedling tea bushes show this pattern also and there is little doubt of the virus nature of this disease although the actual proof of transmission through grafting has not yet been achieved (Fig. 9). The only proved virus symptoms of wide occurrence is the phloem-necrosis complex (Fig. 11).

The phloem-necrosis virus disease expresses itself in many symptoms and is of different appearance on each seedling bush infected with it. For a full description of the many symptoms the reader may refer to Bond (1944).

10. In connection with the leaf symptoms described here, only the vein-clearing symptom of the phloem necrosis disease is mentioned. The symptom of vein clearing consists of a narrow yellow band immediately along the major veins. This was found on several low-jat bushes showing phloem necrosis. It is therefore considered to be part of the complex symptoms caused by the phloem necrosis virus (Fig. 10).

This completes the series of known patterns of discolourations of tea leaves. Most of these symptoms occur on up-country estates. Two reasons can be suggested. Firstly, it is well known that many virus symptoms occur only at lower temperatures. None of the symptoms supposed or known to be due to a virus occur in the low-country. Secondly, amongst seedling plants, hybrids show more tendency to develop into variegated plants, and tea on up-country estates is in general more of a hybrid nature than low-country tea.

All these abnormalities and virus diseases together do not form a threat to the tea industry as a whole, but it is essential to have them recorded.

If any abnormality should then occur in clonal tea on a large scale we should be able to identify it immediately and judge its potentialities of spreading.



Figure 1. Non-infectious variegation.
A. Fully developed
B. Intermediate stage
C. Weakest form

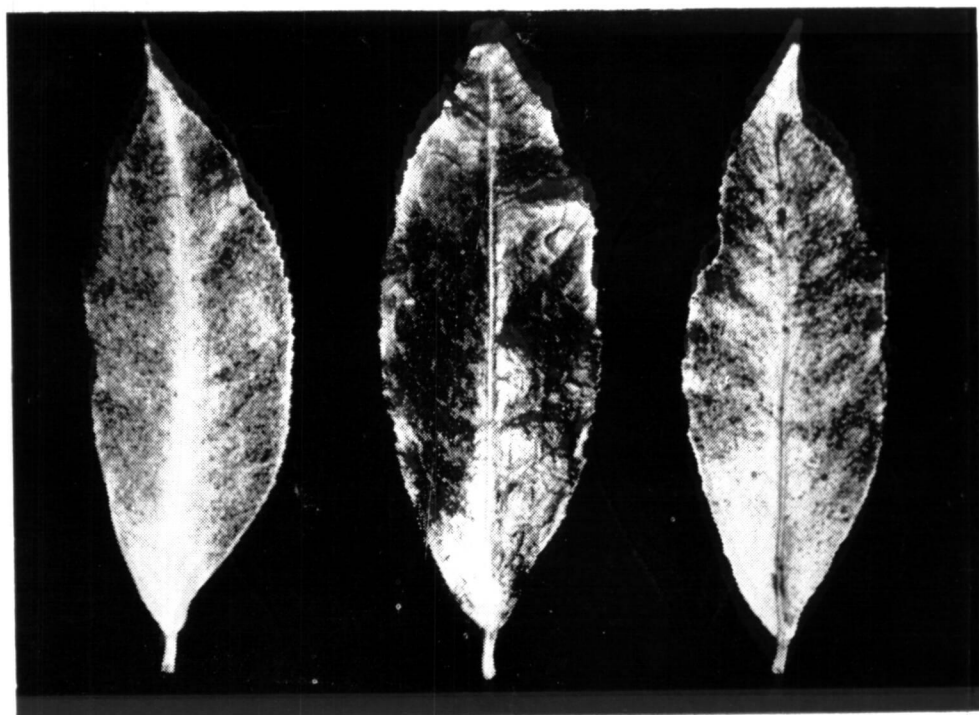


Figure 2. Speckled-leaf condition

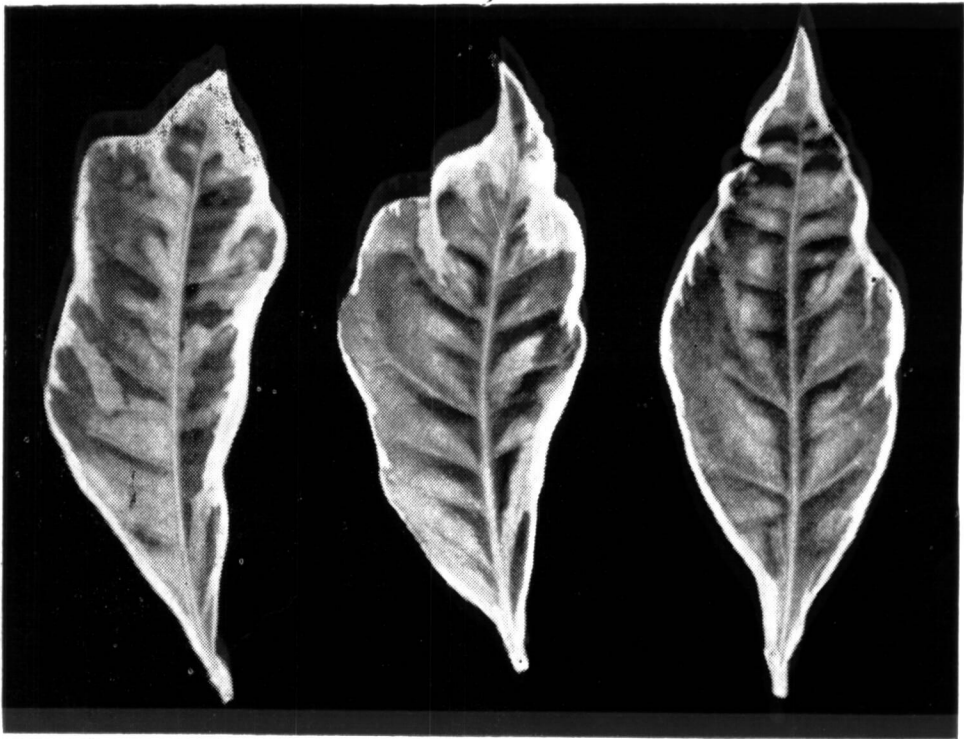


Figure 3. White margin (bud mutation)

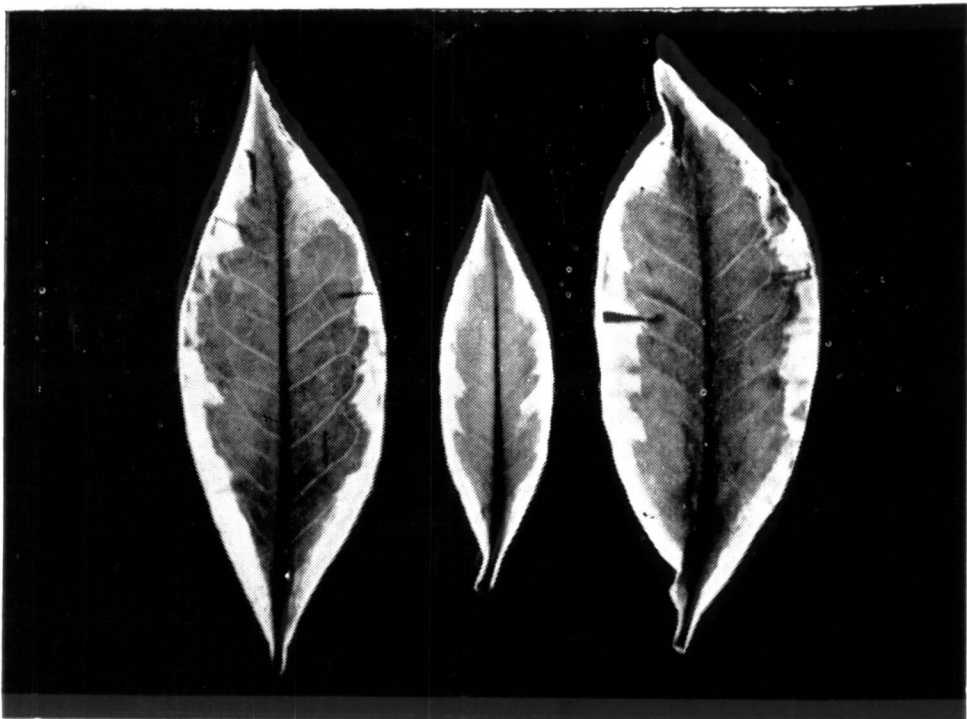


Figure 4. Yellow margin (bud mutation)

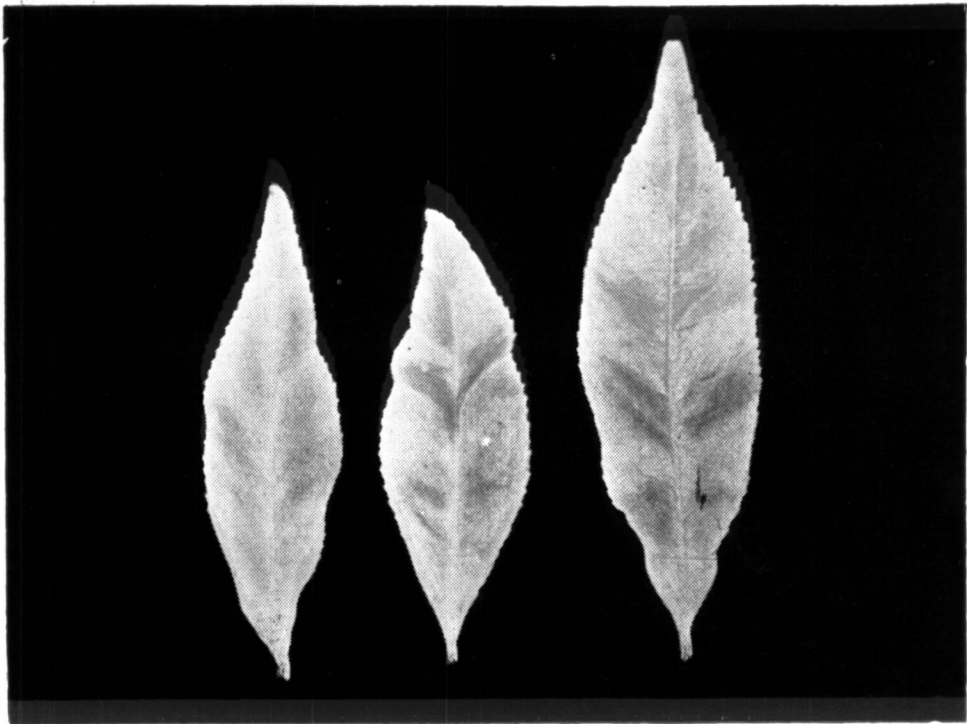


Figure 5. White leaf (bud mutation)

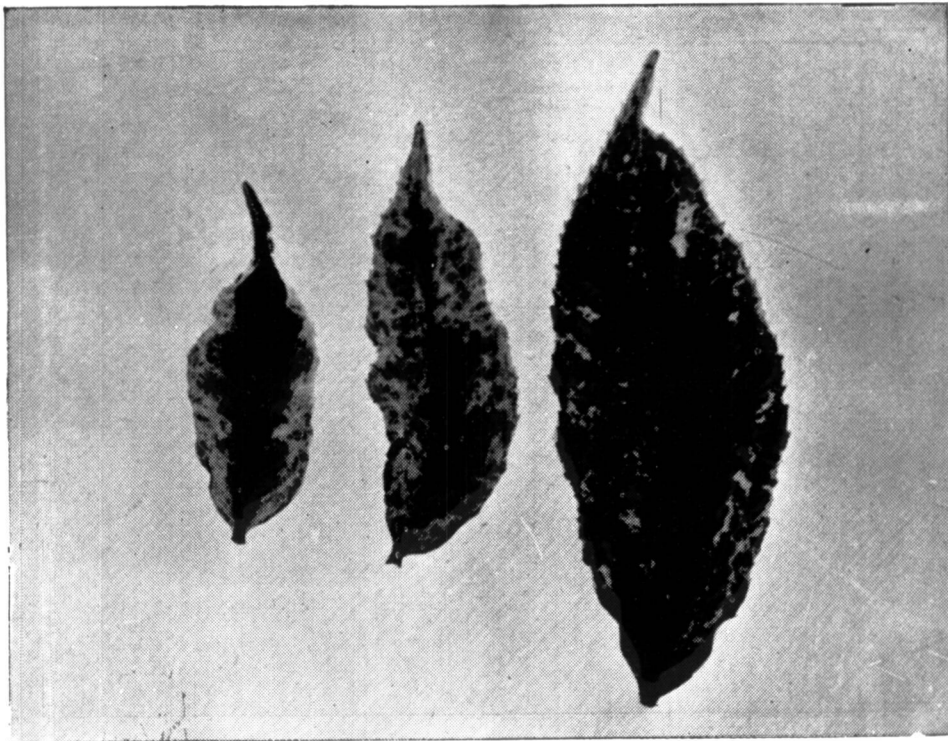


Figure 6. White-streak mosaic (Gadd's infectious variegation)



Figure 7. Yellow-streak mosaic

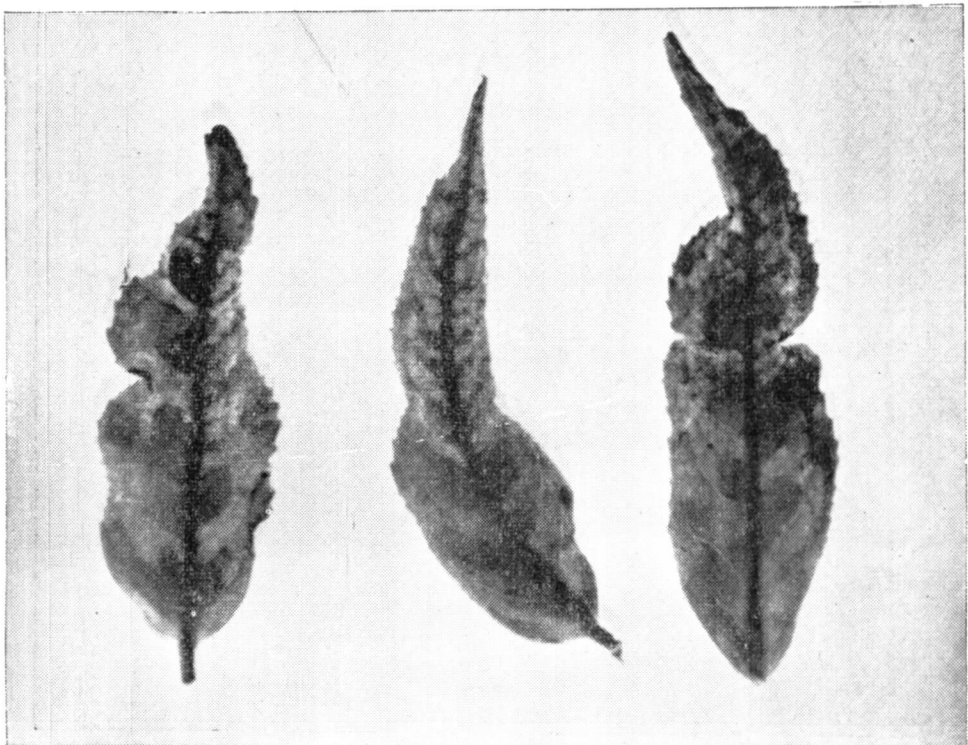


Figure 8. Crinkle-leaf condition

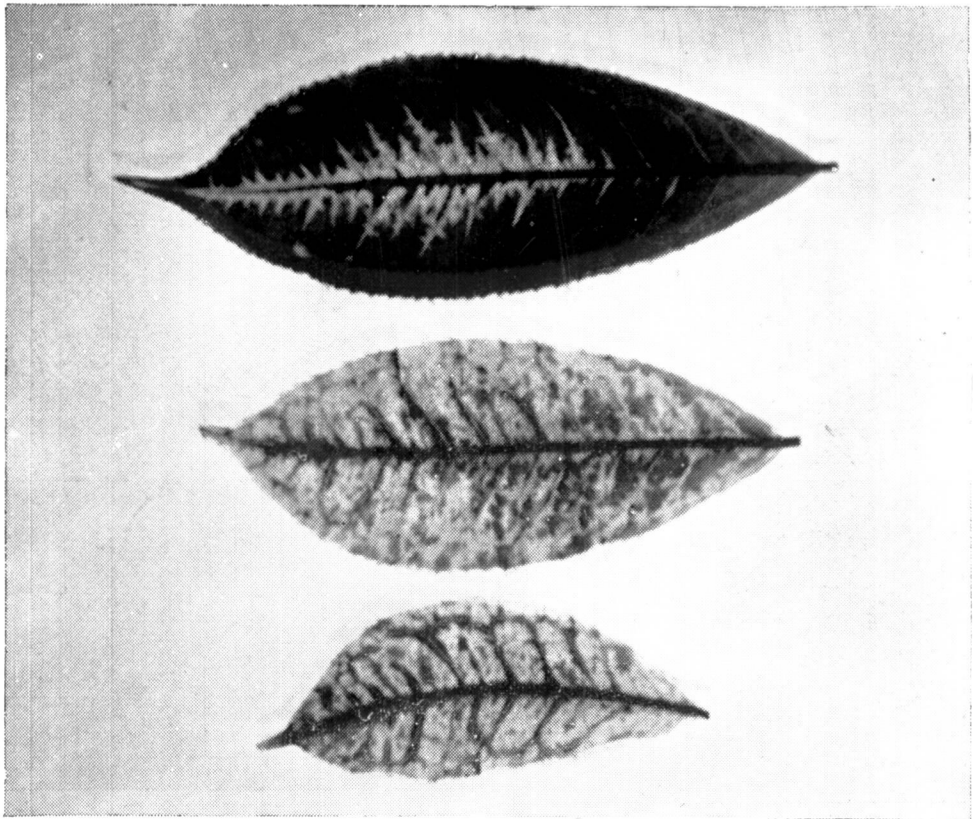


Figure 9. Oak-leaf pattern (vein-banding symptoms) not connected with phloem necrosis

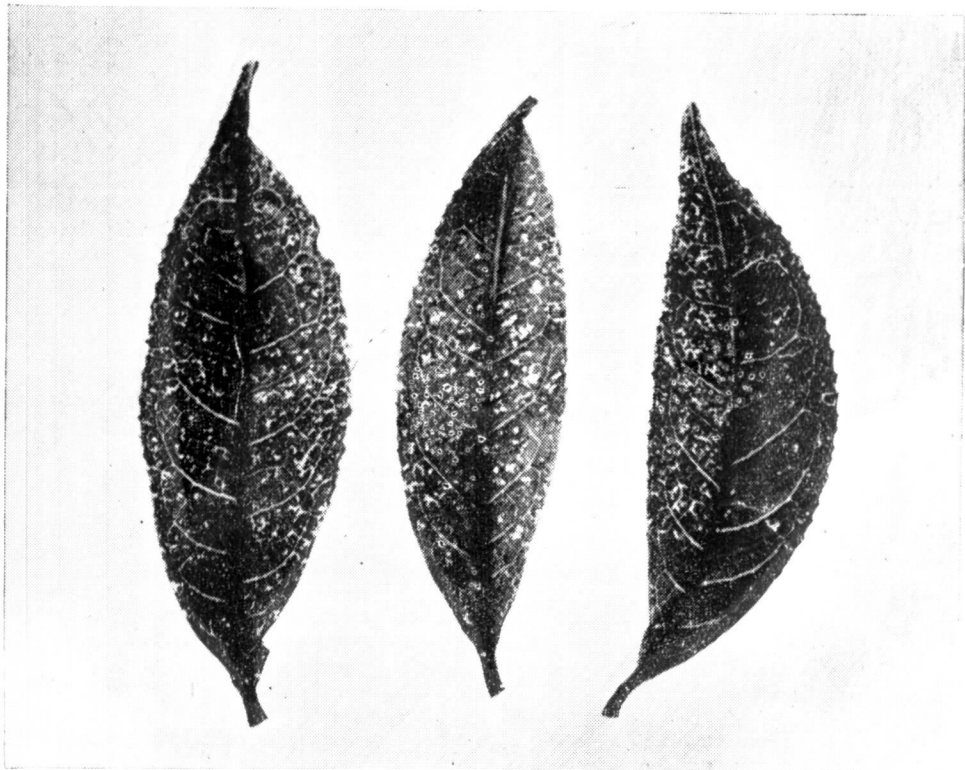


Figure 10. Vein clearing (connected with phloem necrosis.)

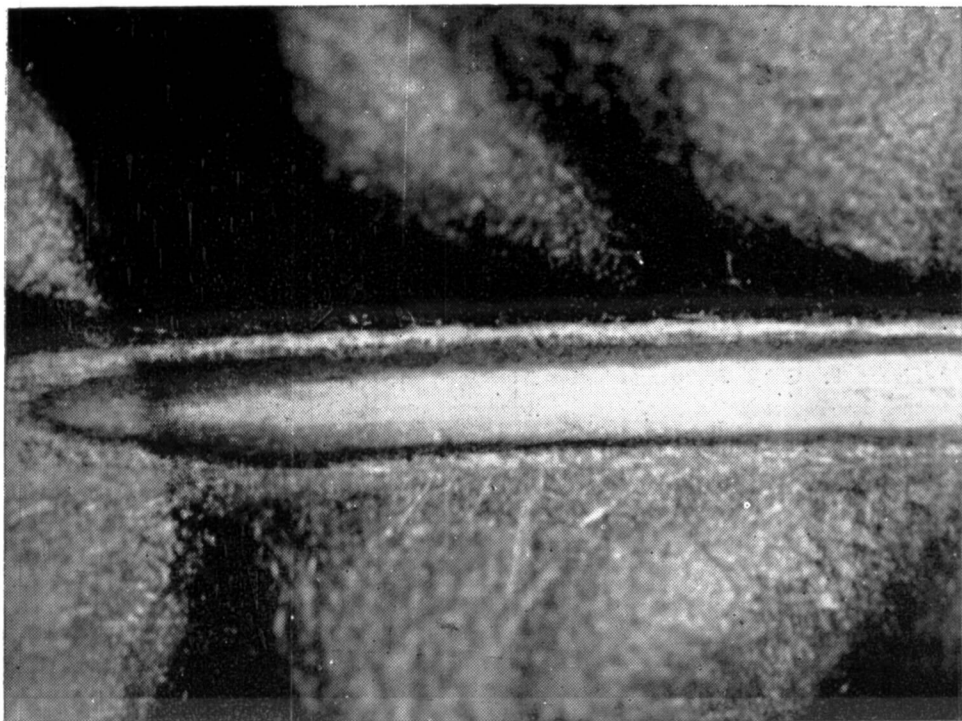


Figure 11. Phloem necrosis (longitudinal section of the underside of a mid-rib, showing the dark necrosis of the phloem tissue).

References

- BOND, T. C. T. (1944). Phloem necrosis virus disease of tea in Ceylon. *Ann. appl. Biol.* **31**: 40-46.
- GADD, C. H. (1949). The commoner diseases of tea. *Monogr. Tea Prod. Ceylon* no 2, 94 pp.
- MULDER, D. (1959). Report of the Plant Pathologist for 1958. *Rep. Tea Res. Inst. Ceylon*, 62-66.