

THE SYMPTOMS OF CHLOROSIS DUE TO HIGH LIGHT-INTENSITY ON TEA LEAVES AT HIGH ELEVATION

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As was pointed out in an earlier article (Mulder and de Silva, 1959), symptoms of chlorosis can have various causes.

Apart from abnormalities in the mineral nutrition the following agents can cause chlorosis in tea:—

1. genetic constitution (yellow margin of leaves over the whole bush);
2. bud mutation (mottled appearance on one branch);
3. Red Rust in the bark (one-sided chlorosis of leaves on a few branches kept as feeders);
4. a virus disease (oak-leaf pattern);
5. high light-intensity (at high elevation).

It is this last point especially which is under discussion in this article.

Chlorosis due to abnormal illumination is usually called etiolation. Both too low and too high light intensity can cause etiolation of leaves of plants. Chlorophyll formation and chlorophyll breakdown are both processes which depend on the light-intensity.

Plants grown in the dark are devoid of any chlorophyll, because no chlorophyll can be formed. Plants grown under conditions of very high light-intensity also sometimes develop symptoms of etiolation but this is due to abnormally rapid breakdown of chlorophyll.

Not all plants show this latter symptom and not all varieties of one species react in the same way. In the first place, only plants that are able to grow under conditions of weak light are liable to show etiolation or chlorosis due to high light-intensity. Of these species, only the varieties that are specially sensitive to light show this reaction.

Among mature seedling bushes, we find a number of individuals that show a bright chlorosis during a sunny period when grown at high elevations, especially shortly after pruning when growth is fast (Fig. 1). This symptom could be confused with the symptoms of magnesium deficiency and it might therefore be useful to describe it in more detail (*see* Fig. 2). Firstly, the occurrence is different; we find it on the younger leaves of the tipping shoots. The chlorosis is marginal as with magnesium deficiency but is more whitish. Instead of showing up on the majority of bushes it is restricted to a rather small number of bushes. Confusion with a genetically-conditioned chlorosis is also possible; the latter symptom, however, is very rare and occurs only on an odd bush here and there.

The first indication that this kind of top-leaf chlorosis is due to excess light was obtained from the fact that it occurs especially during sunny periods and not



Figure 1. Tea bush showing chlorosis due to high light-intensity at an elevation of 7000 ft.



Figure 2. Some tea shoots showing etiolation of the young leaves due to high light-intensity.

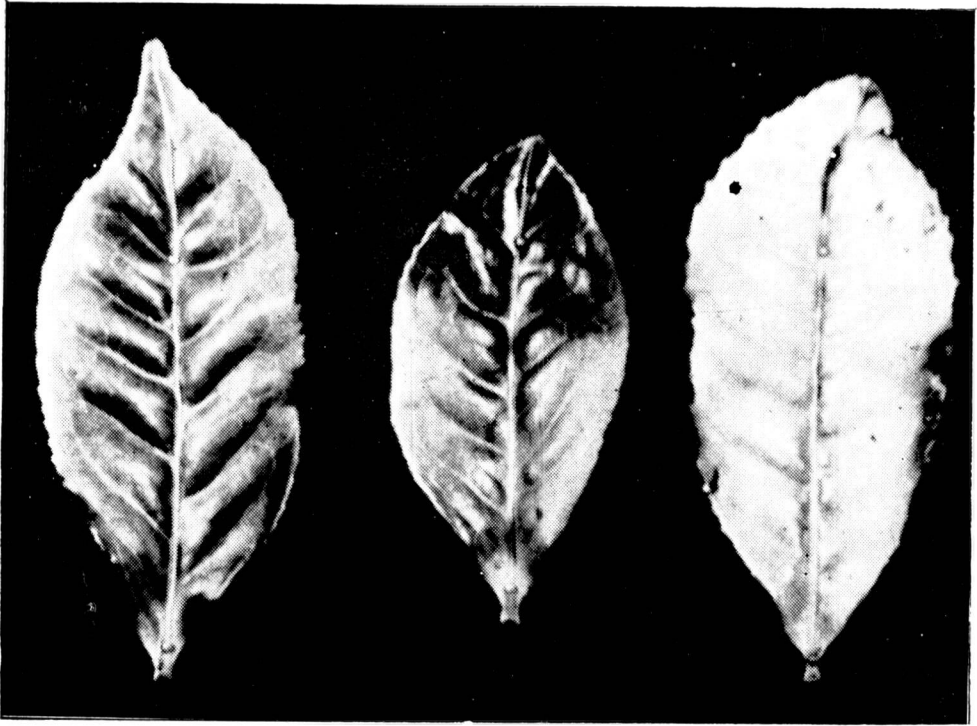


Figure 3. Etiolation of leaves due to high light intensity. The central leaf shows the protective effect of shading by another leaf on the upper half (green).

during cloudy weather. The second piece of evidence was an observation on a few leaves in the field. Wherever a young leaf is partly shaded by another leaf the etiolation on the former occurs only on the unshaded part (see Fig. 3). In the third place, proof was obtained by a small experiment on the shading of a few sensitive bushes that had developed symptoms of chlorosis earlier. The shading effected a marked improvement of the colour of the leaves compared with that of unshaded bushes.

Although quite a number of bushes can develop this type of chlorosis it must be kept in mind that the majority are capable of retaining their full green colour under the same circumstances. The question whether tea is a shade-loving plant cannot therefore be answered without qualification. We should formulate this question as follows:—does the species *Camellia sinensis* contain types or varieties which are shade-loving? If we put it like this, the answer is yes.

The type of chlorosis described here occurs mainly above 4,000 ft where shade is thin, and is most prevalent on estates above 6,000 ft where only windbreaks are in existence. There is probably no solution to this problem on a plantation where types that need shade are occurring mixed with types that do not need shade. Introduction of shade trees on these high estates is not likely, and is not desirable because the temperature of the bush would stay too low. Fundamentally, this chlorosis is the outcome of the divergence between temperature and light-intensity at the highest elevations. Whereas the light-intensity goes steadily up with elevation, temperature goes down. For a sufficiently rapid metabolism of the tea leaf a certain temperature is needed. The breakdown of chlorophyll increases with light intensity and at a certain elevation the point is reached where the speed with which chlorophyll is formed is not enough to replace the loss created by high light-intensity.

These observations and deductions may be of interest for those who have to select clones for multiplication at higher elevations. Types that go yellow in the top leaves during sunny periods are not the most suitable ones, because their growth will be hampered under those conditions.

Reference

- MULDER, D. & DE SILVA, R. L. (1959). Deficiency diseases and the symptoms of magnesium deficiency. *Tea Quart.* 30: 157-165.