Advisory leaflet **15**
1983

SOUTH PACIFIC COMMISSION

TOMATO LEAF MOULD

Symptoms of tomato leaf mould caused by the fungus Fulvia fulva.

TOMATO LEAF MOULD is caused by a fungus now usually called *Fulvia fulva*, but in the past referred to as *Cladosporium fulvum*. The disease is of world-wide occurrence, and is probably present wherever tomatoes are grown in the South Pacific. Within the South Pacific Commission region it has been reported from American Samoa, Cook Islands, Fiji, French Polynesia, Guam, New Caledonia, Niue, Papua New Guinea, Solomon Islands, Tonga, and Western Samoa.

SYMPTOMS

The fungus usually infects only the leaves, producing a velvety mould growth on the lower surface. It is from this obvious symptom that the disease takes its popular name. In severe cases, flowers, and occasionally the fruit, are also attacked. Rarely is visible mould growth produced on the surface of the fruit.

The lower leaves are usually infected first, and are the most affected. In favourable conditions the disease spreads upwards. The first symptom is a pale yellow mottling on the upper surface of the leaf, with corresponding pale areas on the lower surface. The mould becomes visible firstly as a light grey growth with a whitish margin, within the pale areas on the underside of the leaves. With time, the mould growth darkens to brown, olive green, or purple. The upper surface yellows and then browns, but only occasionally does a mould growth appear on the upper surface. Infected areas generally coalesce, and the leaf then turns brown and withers — the dead leaves usually remaining attached to the plant.

INFECTION

The mould growth on the leaves consists of an intertwining mass of filaments and stalks (conidiophores). These arise from threads (mycelium) growing within the leaf. The conidiophores bear chains of spores (conidia) along their edges and at their tip (Fig. 1). The conidia are readily detached and blown in the wind, or splashed by rain-drops to other leaves where they germinate and give rise to fresh infections. Under optimum conditions it takes about fourteen days from infection to the development of a sporing mould growth. The conidia require periods of high humidity (95%+) for germination and growth, and temperatures in the range 10–34°C (22–26°C optimum). The disease thus becomes destructive in moist sub-tropical areas and during wet, cooler periods in tropical regions. In temperate areas, it is mainly a disease of glasshouse-grown tomatoes. During the dry season, leaf mould becomes less common and instead another disease, early leaf blight *(Alternaria solani)*, may occur.

Conidia will remain viable in a dry condition for at least twelve months. Exposure of conidia to high temperature (46°C) and strong sunlight is lethal, but once within a plant, the fungus is better able to withstand adverse conditions. The fungus may survive between successive crops, as mycelium within diseased plant debris.

Spread from plant to plant is by wind-blown or rain-splashed conidia, and by fungal material that has remained viable within plant debris. Whilst seed contamination can occur, this method of dispersal is probably of little importance.

EFFECT OF THE DISEASE

The extent of damage and yield loss depends largely upon the stage of plant growth at which infection occurs. If plants become infected before fruit is formed, considerable loss of crop may occur, presumably owing to a reduction in the effective leaf area. Infected flowers may fail to set fruit, and occasionally the fungus can cause an internal blackening of fruit.

CONTROL

Removal of diseased leaves

Any heavily infected lower leaves should be removed and burnt as soon as the first three or four fruit trusses have been picked. The remains of a diseased crop must also be burnt.

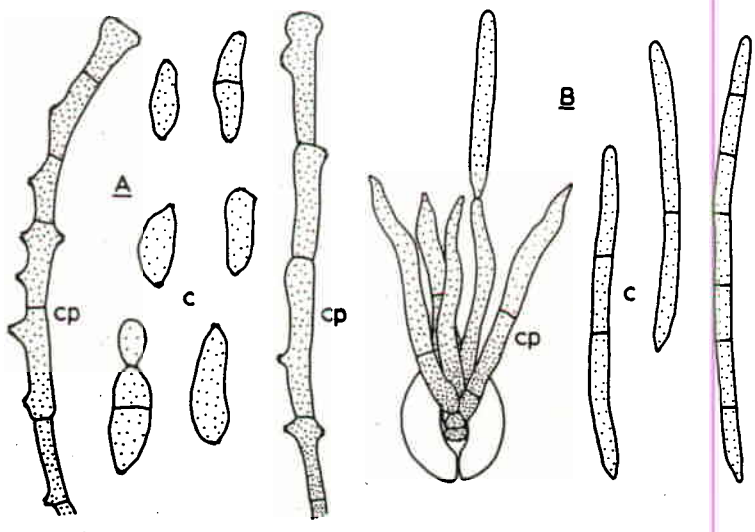

Fig. 1. *A. Conidia (c) and conidiophores (cp) of* Fulvia fulva. *B. Conidia (c) and conidiophores (cp) of* Pseudocercospora fuligena. *(Magnified 840 times.)*

Chemical control

A wide range of fungicides are effective against leaf mould. In the South Pacific Commission region benomyl, maneb and mancozeb have been recommended, but others such as carbendazim, chlorothalonil, dichlofluanid, triforine, and zineb are effective (Table 1). Copper formulations can be used, but they may harden the foliage.

Fungicide treatment should be started early, about the time of appearance of the first flowers, before the disease becomes a problem. Regular spraying at 10–14 day intervals is required, until about 3–4 weeks before final harvest. It is important to apply a good coverage of fungicide to both surfaces of the leaves — particularly the underside, and to ensure coverage of the young green leaves. The spray should be applied to run off.

Benomyl and carbendazim act as both preventative and eradicant fungicides. Unfortunately, it is possible that strains of the fungus may arise which are resistant to these chemicals. Triforine may also have some eradicant action, and no strains of the fungus resistant to this chemical are known. The other

Table 1. Fungicides and spray concentrations (g/litre) suitable for the control of tomato leaf mould

Benomyl	Carbendazim	Chlorothalonil	Dichlofluanid	Maneb	Mancozeb	Triforine	Zineb
0.5	0.5	1	0.5	2	2	0.3	1.5

These concentrations refer to the amount of active ingredient required in sprays applied to run off. Commercial formulations of these fungicides will contain only a proportion of active ingredient. Therefore, concentrations of the commercial formulations will need to be increased accordingly.

fungicides, which are preventatives, are also effective against early blight, late blight *(Phytophthora infestans)*, *Didymella* rot *(Didymella lycopersici)*, and *Stemphylium* leaf blight *(Stemphylium lycopersici)*. Simultaneous control of these diseases may be desired.

Resistance

The most effective and inexpensive means of control is through the use of host-plant resistance. Many tomato varieties and hybrids with resistance to leaf mould and other diseases have been bred. Unfortunately, several physiologic races of the fungus exist, and whilst newer tomato varieties are usually resistant to some of the races, they may not be resistant to all the local strains of the fungus. In some tomato varieties, resistance has been overcome by the fungus. Apparent loss of resistance may, however, be due to infection by the very similar *Pseudocercospora* leaf mould (see below). In selecting tomato varieties for trial, it is important that they have suitable agronomic characters for growth in the tropics, and this may include resistance to other diseases, particularly bacterial wilt *(Pseudomonas solanacearum)*.

Pseudocercospora leaf mould, or leaf spot, is caused by the fungus *Pseudocercospora fuligena*, previously known as *Cercospora fuligena*. The symptoms are similar to, and can easily be mistaken for, those of *Fulvia* leaf mould. *Pseudocercospora* leaf mould is largely restricted to the tropics and is found mainly in Central and South-east Asia. Within the South Pacific Commission region it is recorded from Cook Islands, New Caledonia, Papua New Guinea, Solomon Islands, and Vanuatu. A record of *Cercospora* sp. leaf spot from Ponape (Federated States of Micronesia) possibly refers to this disease.

Disease symptoms are almost identical to those of *Fulvia* leaf mould, the two diseases can be distinguished with certainty only by a microscopic examination of the sporing mould growth. The brown or dark brown mould growth, which occurs mainly on the lower surface of the leaf, consists of groups of conidiophores, each conidiophore bearing a conidium at its tip (Fig. 1).

Environmental conditions suitable for infection and spread are similar to those required by *Fulvia*, although *Pseudocercospora* is favoured by slightly higher temperatures. There are varietal differences in susceptibility to *Pseudocercospora*, but little work has been done in this field. Crop hygiene and the fungicides used against *Fulvia* leaf mould should also be effective against *Pseudocercospora* leaf mould.

□ □ □

This leaflet was prepared by E.H.C. McKenzie, Plant Diseases Division, Department of Scientific and Industrial Research (DSIR), Auckland, New Zealand. Photographs were taken by M.L. Lessiter, Photographic Section, DSIR, Auckland. Further information can be obtained from the Plant Protection Officer, South Pacific Commission.

Published by the South Pacific Commission and printed by Shepson Printery (Letterpress and Offset) Pty. Ltd., Sydney, N.S.W., Australia. Commission publications may be obtained from the **South Pacific Commission, BP D5, Noumea Cedex, New Caledonia.**