



Kava dieback

Kava dieback disease is the most important cause of losses to kava production in the South Pacific. Outbreaks of the disease which have almost completely destroyed kava plantings have been observed in recent years in the main kava-producing nations of the Fiji Islands, Vanuatu, Tonga and Samoa. When kava plants are affected by dieback, some or all of the stems rot and die back to the stem base (Fig. 1). The plant is either partially or completely killed.

Kava dieback is thought to be caused by cucumber mosaic virus (CMV), either alone or in combination with one or more unknown agents (Davis, 1996). CMV causes important diseases of crops across the world. This virus is unusual because it has a very wide host range. It can infect over 800 different plant species. CMV is spread from plant to plant by aphids.



Fig. 1. Kava plant showing dieback

SYMPTOMS

1. Leaf symptoms

Some of the leaves on infected stems develop symptoms of virus infection several weeks before the stem dies back. Young expanding leaves show patches of yellow tissue against a green background. Each patch has a sharply defined boundary. This symptom is known as mosaic. The mosaic usually appears together with certain leaf growth distortions. These can be a crinkling (Fig. 2), a blistering, or a puckering along

the leaf veins (Fig. 3). Sometimes the mosaic appears in combination with two, or even all three, of these other leaf symptoms. On older leaves, the mosaic patches become yellow blotches because the leaf has expanded (Fig. 4). Occasionally, a general yellow colour of leaves, with dead and brown leaf edges is the only symptom seen before stems rot.

Infected kava plants also sometimes wilt.

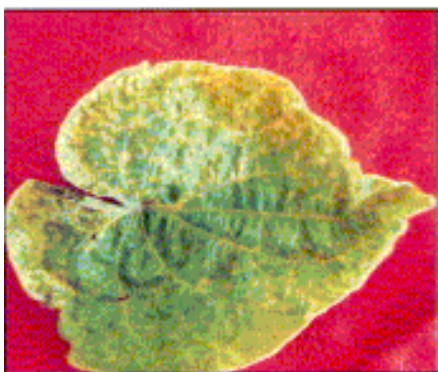


Fig. 2. Kava leaf showing crinkling

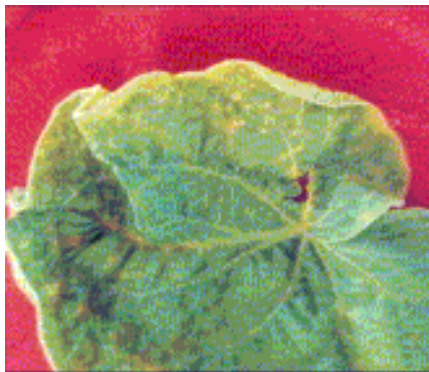


Fig. 3. Kava leaf showing puckering



Fig. 4. Kava leaf with yellow blotches

2. Signs of stem rot

The first signs of rot can often be seen inside the stem when stems showing leaf symptoms (but no other outward signs of disease) are cut open. The rot appears as brown streaks or lines in early stages (Fig. 5). Later, the decay becomes more general (Fig. 6).



Fig. 5. Early stem rot of kava

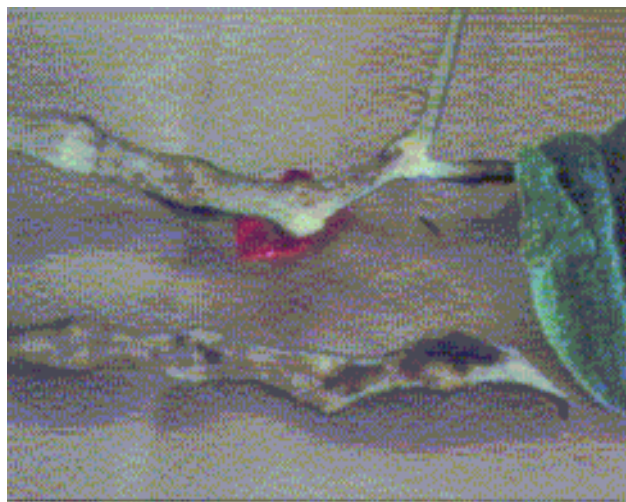


Fig. 6. Decay of kava stems

Dieback first becomes visible on the outside of the stem as a black, soft rot either at the tip, the stem branches, or the nodes. As the rot spreads, stems either rot back from the tip to the base or collapse in the middle. Stems usually disintegrate completely (Fig. 7). New shoots arise at the stem base and cycles of dieback followed by regrowth are common (Fig. 8).



Fig. 7. Stem rot of kava



Fig. 8. Regrowth of kava

TRANSMISSION OF THE VIRUS

When aphids feed on leaves infected with CMV, they pick up the virus on their mouthparts. When they move to another susceptible host plant and feed again, the aphids transmit the virus to the new plant and it multiplies and spreads within that plant. CMV is a non-persistent virus. This means that aphids pick up and transmit CMV in a few minutes and remain infectious only for several hours. The melon or cotton aphid (*Aphis gossypii*) is common on kava and this aphid is known to transmit CMV and kava dieback. CMV is also carried over into new plantings when stems used for planting material are cut from infected plants.

SPREAD

Dieback disease usually starts in a low number of plants, scattered randomly across the planting. These are known as primary infections and they are thought to originate in one of two ways: from infected planting material, or from incoming flying aphids, which picked the virus up from elsewhere. Primary infections expand and spread, to become larger patches of diseased plants. This is known as secondary spread and is a direct result of movement of aphids between plants in the garden. Patches of dieback affected plants are 'hot spots' of infection and they increase in size when conditions are favourable.

DISEASE MANAGEMENT STRATEGIES

No acceptable CMV-resistant cultivars of kava have yet been found. There are no chemical sprays available which kill the virus in infected plants. Spraying to kill aphids does not give effective control of diseases caused by non-persistent viruses. A number of other control recommendations are suggested below. They work by reducing either primary infections or secondary spread or both.

1. Choice of planting material

Disease-free planting material should be used. This will greatly reduce the number of primary infections. Stems for propagation should be selected carefully. Planting material should not be cut from plants showing the leaf or stem symptoms described above. Plants without such symptoms but with stems which appear to have rotted back some time before, should also be avoided. This is because an infected plant can show symptoms of the disease which come and go in cycles.

A low level of infection exists without symptoms. This means that the disease can be carried over in stems cut from plants which appear to be uninfected. Kava plantings which contain disease 'hot spots' should therefore be avoided when choosing planting material. This is because some, apparently healthy, plants growing in such plantings are quite likely to be carrying the virus. Because of this, the best choice of planting material would be stems cut from plants growing in regions or on islands where the disease is not known or is uncommon.

2. Roguing or early harvest

Infected plants should be eliminated as soon as they are detected, before the disease is allowed to spread. This is known as roguing. To rogue effectively, growers should learn to recognise early dieback symptoms and regularly inspect their crops. CMV infection does not reduce the suitability of kava for human consumption. When roguing is timely, the root and stem base will not have rotted away and will therefore still be good for drinking.

3. Maintenance of traditional growing techniques

The best way to grow kava is in a traditional multicrop garden in partially cleared forest. It should be interplanted with several different crops and grown below a tree canopy.

There are three reasons for this:

(i) Kava grows better if it is partly shaded.

(ii) Young kava plants are too small to occupy all the land available. This space can therefore be used to produce other profitable, quick-return crops.

(iii) Growing kava in traditional mixed-crop gardens reduces dieback disease development.

This control method takes advantage of the non-persistent nature of CMV. When aphids carrying CMV arrive in such a garden, many will feed first on the other plants and not on kava. If these plants are not hosts of CMV, the aphids lose the virus from their mouthparts and become unable to infect kava. Similarly, as aphids move through a mixed garden in which some kava dieback occurs, many which pick up CMV from infected kava will feed on a non host and lose the virus before moving to another kava plant.

Suitable intercrops, which are not known to be hosts of CMV, include cassava, yams, sugarcane, ginger, paper mulberry (used for *tapa/masi*), vanilla, and coconut. Most Pacific Island trees are also probably not susceptible.

4. Removal of other CMV hosts from kava plantings

Other hosts of the virus should be removed from kava gardens. The following Pacific Island crops are well known hosts of CMV: banana, pumpkin or squash, watermelon, tomato, tobacco, capsicum, chili, passionfruit, eggplant, sweet potato, peanuts and many other legumes. It would be advisable not to grow these crops together with kava. In addition, many common broad-leaved weeds are hosts to CMV. Kava plots should therefore be well weeded.

SUMMARY OF CONTROL RECOMMENDATIONS

- ☐ Use only planting material cut from uninfected plants, preferably obtained from regions known to be free of dieback disease.
- ☐ Remove infected plants from kava gardens as soon as they are discovered. Leaves and stems should be burned or buried.
- ☐ Maintain traditional growing practices. Kava should be planted in small and isolated gardens, amongst several different crops and also below a tree canopy.

QUARANTINE PRECAUTIONS

The movement of propagating material out of regions where dieback occurs into regions where it is unknown should be banned.

REFERENCE

Davis, R. I.; Brown, J. F. & Pone, S. P. (1996) Causal relationship between cucumber mosaic cucumovirus and kava dieback in the South Pacific. *Plant Disease* **80** (2), 194-198.

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