

## Tomato Leaf Roll - A Serious Disease in the Top End

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**Figure 1.** A young tomato plant (on the right) infected by tomato leaf roll



**Figure 2.** Tomato leaf roll infected tomato plants without fruit



**Figure 3.** Tomato plant infected later by tomato leaf roll, with small fruit

Tomato leaf roll is one of the two most serious diseases of tomatoes in the Top End. The other is bacterial wilt. Tomato leaf roll is particularly serious along coastal areas. Losses of up to 100% have been recorded and losses of 60% are quite common. In contrast to the 1970s and 1980s, the last several years up to and including 2001 were relatively free of tomato leaf roll. However, in 2002 there was a sharp increase in the reported cases of the disease attacking tomato plants, reaching the severe levels of the 1970s and 1980s.

## SYMPTOMS AND EFFECTS

Plants affected by tomato leaf roll suffer a greatly reduced growth rate and so become stunted or dwarfed. Leaflets are rolled upwards and inwards while the leaves are often bent downwards (epinasty) but are stiff rather than limp as in wilted plants. Leaves are thicker than normal and of a leathery texture and often have a purple tinge to the venation on the undersurface. The newly produced young leaves are paler in colour than those on healthy plants. Fruit, if produced at all on affected plants, is smaller than normal, dry in texture and unsaleable. Plants with an advanced infection will not produce fruit.

## CAUSE

Research at Berrimah Farm has shown tomato leaf roll to be a virus disease which can be experimentally graft transmitted to tomatoes and some other solanaceous plants. **The virus that causes the disease is now known as the *Tomato leaf curl virus, Australian strain (TLCV-Au)* which is a gemini virus.** Our work has shown the virus can be transmitted to tomato plants by the sweet potato whitefly, *Bemisia tabaci*. It is suspected that the TLCV-Au is harboured by some wild plants and is transmitted from them to the tomato plant. Trials have indicated that there is little, if any, transmission from a tomato plant to another tomato plant. **The TLCV-Au also causes a stunting disease of zinnias in the Darwin area.**

The related exotic virus *Tomato yellow leaf curl virus (TYLCV)* severely affected tomato plants in south east Queensland in early 2006. This was transmitted by the poinsettia or silverleaf whitefly (Agnoto No. I27).

Once a plant is infected with tomato leaf roll TLCV-Au moves through the sap and eventually invades the whole plant. Because of this, the virus cannot be prevented from invading other parts of a plant by pruning affected branches. The virus is not known to be transmitted through seed or through the soil.

Trials have shown that the incidence of tomato leaf roll was highest early in the year and then subsided progressively. For instance, crops sown in March had far less leaf roll than those sown in February.

When grafting tomatoes on to the wild Malay eggplant to control bacterial wilt, it needs to be kept in mind that the eggplant is a symptomless host of the tomato leaf roll disease. Symptomless infected eggplants will infect tomato scions with TLCV-Au through the graft.

## OTHER CAUSES OF SIMILAR SYMPTOMS IN TOMATOES

Tomato leaf roll can be confused with several other conditions, namely tomato big bud disease, physiological leaf roll, phosphate deficiency, tomato yellow top and potato spindle tuber.

Tomato big bud is a phytoplasma disease which has been rarely seen in recent years. It affects plants in a similar way, although a soft fern like leaf growth is produced. The critical distinguishing factor is that tomato big bud disease produces green flowers, whereas tomato leaf roll disease does not.

A physiological leaf roll is often confused with the tomato leaf roll virus disease. Physiological leaf roll does not stunt the plants and the young expanding leaf is soft, whereas the young expanding leaf in tomato leaf roll diseased plants is more rigid.

Phosphate deficiency causes hard stunted plants with a purplish tinge. All parts of the plant are reduced in size, in contrast to tomato leaf roll where only new growth, produced after infection, is reduced in size. Even when superphosphate has been applied, plants may be phosphate deficient if the phosphate was not fine enough and distributed evenly enough so that it is within reach of plant roots. With phosphate deficiency, affected plants are more or less evenly distributed in the planting, whereas tomato leaf roll virus-diseased plants occur in random distribution through the field.

Tomato yellow top is another virus disease. It is found in New South Wales and southern Queensland but not in the NT. The disease is spread by aphids. Symptoms are very similar to those of TLCV-Au. Infected plants have a stiff upright appearance, with overall chlorosis (yellowing), and leaflets are reduced in size and are rounded with marginal chlorosis.

Potato spindle tuber is caused by a viroid (as distinct from a virus). This viroid can infect tomato plants and symptoms include an almost complete cessation of growth of the terminal branches with condensed growth of the shoots giving the leaves a "crowded" appearance. Leaves already developed at the time of infection retain a healthy appearance. Subsequent growth above the zone of condensed growth can have an elongated appearance. In the advanced stage of infection, the leaves can be chlorotic (yellowish) and have a purple tinge. At this stage, it is difficult to distinguish between this viroid disease and virus diseases such as tomato leaf roll.

## CONTROL

No commercial varieties have been found that are resistant to tomato leaf roll. Commercially, plants are dusted or sprayed with insecticide but still may become infected with tomato leaf roll disease because the insect can transmit the virus before it is killed. Because there appears to be little if any secondary transmission from one tomato plant to another tomato plant, roguing (removal of affected plants) will not reduce the spread of the disease.

In the Middle East, inter-planting tomatoes with cucumbers was found to decrease the incidence of TYLCV infection in tomato crops because cucumbers are more attractive to whiteflies than tomatoes. Inter-planting cucumbers or squash among the tomatoes could have a similar beneficial effect here in decreasing the incidence of TLCV-Au, which is transmitted by a whitefly in tomatoes, because TLCV-Au and TYLCV are somewhat related.

At present, the best thing to do to avoid large numbers of tomato leaf roll affected plants is to sow later in the season. For example, sowing in late March for planting in mid-April could be suitable, depending on the season.



**Figure 4.** Infected apical shoot showing stiffness and upright appearance

## FURTHER INVESTIGATIONS

The Plant Pathology Branch in co-operation with other organisations is continuing further investigations aimed at controlling this disease of tomatoes. **We would welcome any information on incidences of tomato leaf roll disease or stunting disease of zinnias. Please phone Barry Condé on 8999 2265.**

## REFERENCE

Condé, B.D. and Connelly, Megan I. (1994). Australian tomato leaf curl virus, a whitefly-transmitted geminivirus causing a disease of tomatoes in Northern Australia. *Proceedings of the 4th International Conference on Plant Protection in the Tropics*, Kuala Lumpur Malaysia, 28-31 March 1994, pp. 235-7.

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