

Common Diseases of Citrus in Malaysia

by
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Citrus belongs to the plant family, Rutaceae. It has many species. In Malaysia, the common ones are *Citrus reticulata* (honey orange, langkat), *Citrus aurantifolia* (kasturi lime), *Citrus limon* (lemon) and *Citrus grandis/maxima* (pummelo). Malaysia imports some of the Mediterranean oranges like the Valencia and Navel oranges, Murcott mandarins, tangerines, grapefruit and Eureka lemons.

Commercial planting of citrus in Malaysia has both its benefits and challenges. The fruit has a longer shelf life, travels well and has a wide range of consumers. Its challenges are mainly due to disease infections. The diseases are caused by viruses, bacteria and fungi. In Malaysia, particularly Sarawak, there are two bacterial diseases, one viral disease and at least six fungal diseases. However, some of the fungal diseases are of no economic consequences. The two important bacteria that cause citrus greening disease (CGD) and citrus canker are “*Candidatus Liberibacter asiaticus*” and *Xanthomonas axonopodis* pv *citri*, respectively. The viral disease is caused by the citrus tristeza virus (CTV). The six fungal diseases are gummosis, scab, pink disease, velvet blight, sooty mould and greasy spot, with the last two being considered minor diseases. This article aims to enlighten readers on some of the problems that they may face with their citrus trees in their home gardens or orchards. Each disease is discussed here briefly.

Citrus greening disease (CGD)

The bacterium causing CGD, “*Candidatus Liberibacter asiaticus*” resides in the phloem tissues of the citrus tree. It is transmitted through marcotted planting material and by an insect vector, a psyllid known as *Diaphorina citri*. The infected tree initially shows symptoms that resemble zinc and manganese deficiencies, sometimes with only part (sector) of the tree showing the symptoms. This is known as the sectorial effect (Fig. 1), which is a result of infection brought by disease-carrying psyllids. An infected tree produces smaller fruit, that can be sour and that drops prematurely. Infected trees have more erect branches and smaller leaves. The leaf symptoms include interveinal chlorosis, small leaves with a leathery texture, curling backwards of leaves from shoots and narrowing of leaf lamina. Leaf mosaic and mottling symptoms are also present. The branch internodes are stunted. A few years later, dieback of the infected tree occurs (Fig. 2), eventually leaving a skeletal looking tree in the field.

There is no cure for infected trees. Removal of infected trees will prevent the spread of the disease to other trees. Frequent vector control with insecticides becomes necessary if the infected trees are not removed, and this has been proven to be not effective in stopping the spread of the disease in big orchards. The psyllid, also breeds on the curry leaf plant (*Murraya/Berbera koenigii*) and the ornamental jasmine orange plant (*Murraya paniculata*). Ensuring that all the initial planting materials are free from the disease and planting in non-infected areas are vital to the success of the orchard.

This disease has destroyed many orchards in Asian countries and is now found in South Florida. Two other species of the same disease are devastating citrus orchards in Africa and Brazil. This bacterium is considered an invasive species by the Malaysian Plant Quarantine, which means that it is not indigenous to Malaysia.

Citrus canker

In humid tropical areas, citrus canker is an important disease. The bacterium, *Xanthomonas axonopodis* pv *citri*, attack the leaves (Fig. 3), fruit (Fig. 4) and stems of citrus, producing water-soaked lesions which later form raised pustules, each surrounded by a pale yellow halo. The pustules are rough to touch. On the rind of the infected fruit, the pustules sometimes sink in the centre, producing crater-like lesions, occasionally with a yellow halo. Old lesions on the fruit and stem may turn grey to dark brown, with wart-like appearance.

Bacterial cells ooze out of young lesions and they spread with the help of the wind and rain. Insects, such as the leaf miners (*Phyllocnistis citrella*), also increase the disease incidence by wounding the leaf through their tunneling of the leaf lamina, thereby providing entry points for the bacteria. Contaminated farm tools can transmit the disease from tree to tree. Leaf and fruit drop occur during severe infections. Spraying with copper fungicides and white oil at the initial stage of infection can help to reduce the disease severity. When selecting planting materials, one must ensure that they are free from the disease, as once the disease is introduced into an orchard, it is extremely difficult to eliminate it. Frequent field inspection is important to ensure the disease does not spread to healthy trees.

Citrus tristeza viral disease (CTV)

The citrus tristeza virus, a closterovirus, is transmitted by a few species of aphids, including *Aphis gossypii*, *A. spiraecola* and *Toxoptera aurantii*. It is not seed transmitted, but can be transmitted through grafting and plant sap on farm implements. It can infect many species of citrus. It causes pitting and roping of the branches (Fig. 5) and die-back of the citrus trees. The pitting can be observed more clearly when the bark of the infected tree is peeled off. The leaf symptoms are leaf chlorosis, cupping of leaves, vein clearing and vein corking. The severity of this disease is variable, ranging from mild symptoms to extremely severe, depending on the strain of the virus and the type and cultivar of the citrus. In some countries, the very mild strain of this virus is used to cross-protect the citrus tree from the severe strains, by inoculating the tree with the mild strain of the virus – a process almost similar to the use of vaccines in humans.

It is very important not to obtain planting material from an infected orchard. When severe symptoms are noticed, control the aphid vectors with insecticides such as deltamethrin, cypermethrin or thiamethoxam. Remove the tree if the infection is so severe that it is not economical to maintain. When a citrus tree is infected with both CTV and CGD, the tree succumbs to dieback faster.

Gummosis

Citrus gummosis can be caused by either *Phytophthora nicotianae* or *P. citrophthora*, which are soil-borne fungus-like microorganisms. They produce zoospores that move with the soil water. When the lower tree trunk comes into contact with infected soil through rain splashes or the rising flood water, the zoospores will infect the trunk. The infection gets worse during the wet season. A brown patch lesion appears on the infected trunk (Fig. 6) and sometimes a gummy exudate can be seen oozing out of the lesion. When the bark is peeled, the brown lesion becomes more obvious. Sometimes the infection also occurs on the main roots near the base of the trunk. When the infection becomes more severe, leaf yellowing and wilting occur. Eventually, the leaves and fruit drop, dieback occurs and the tree dies.

To control gummosis, treat the wound after peeling off the bark with the following fungicides, fosetyl aluminium, metalaxyl or potassium phosphonate. Spray on the infected tissue and drench the soil near the infected roots (if they are infected) with the fungicides. Clean up all farm tools and foot wear before using them on other areas of the citrus orchard. Use *Phytophthora* tolerant rootstock, such as Carrizo, when grafted plants are required. Graft the rootstock at a height of 0.5m to provide enough clearance from flood water.

Scab

The fungus, *Elsinoe fawcetti*, infects both the fruit and leaves, producing scabby lesions that look like greyish warts (Fig. 7). Kasturi lime is very susceptible to the disease. Spraying with copper fungicides at the early stages of the disease in an orchard with a history of scab can reduce the disease severity. When it rains, the conidia (fungal spores) are produced and they are spread by rain splash.

Pink disease

Pink disease on citrus occurs in humid areas as a result of infection by the fungus, *Corticium/Erythricium salmonicolor*. A mat of pinkish white fungal mycelia (Fig. 8) can be seen on the infected branches. Leaves turn yellow and drop and the branches dry up and dieback of the branches occur. This disease is favoured by wet weather and the tree can be killed when the major branches are infected. Pruning off the dying infected branches and removing them from the orchard reduce the disease incidence. Spraying with copper fungicides or thiophanate-methyl can control the disease.

Velvet blight

This disease is a minor disease and occurs mainly in orchards that are poorly managed. It is caused by a complex symbiotic relationship between the scale insects and a fungus, *Septobasidium* sp., during the wet season. The scale insects feed on the branches and the fungus grows on the body surface of the scale insects, withdrawing nutrients from the live scale insects for its own growth. In payment for its “food”, the fungus, which forms a thick velvety hydrophobic mycelial mat (Fig. 9), provides a protective shelter for the scale insects and their offspring. To distinguish velvet blight from pink disease, the mat produced by the former is

thicker and velvety, with a purplish white appearance. When it is scraped off, the scale insects or their cast skins can be observed under the microscope. For pink disease, the layer of mat is thinner and consists of fine strands of pinkish white fungal mycelia.

Pruning off the severely infected branches and reducing the tree canopy humidity by removing the excessive main branches can reduce the disease incidence. Spraying with copper fungicides, coupled with any of the insecticides such as deltamethrin, cypermethrin or thiamethoxam can stop the fungus from progressing to the healthy parts of the branches.

Sooty mould

Sooty mould, as the name aptly describes, produces symptoms similar to a layer of soot covering the infected areas (Figs. 10a & b). It is due to the growth of a few fungi, one of which is *Meliola* sp., on the leaf or on the surface of the fruit or branch. These fungi usually occur on parts of the plant where scale insects, aphids or mealy bugs are present. The fungi are attracted to the sweet secretions (honey dew) produced by these insects. Sooty mould is not an important disease and normally does not require any pesticide treatment. In areas with high humidity and where the tree canopy is very thick, disease incidences increase. Reducing the number of branches to increase sunlight penetration into the tree canopy and improving soil drainage can reduce the disease incidences. If necessary, spraying with copper fungicide and white oil (albolineum oil) can reduce the incidences. For home gardeners, spraying with a mixture of laundry or dish washing detergent can reduce the infection.

Greasy spot

This is a very minor disease, caused by the fungus, *Mycosphaerella citri*. Yellow, slightly raised lesions appear first on the undersurface of the leaf, and later they turn brown. Corresponding greasy looking brown lesions also appear on the upper surface (Fig. 11). This disease can also infect the fruit. Only when it becomes severe will the leaves drop. Spraying with copper fungicides can reduce the disease incidence.



Fig.1. Sectorial infection of a citrus tree by CGD.



Fig. 2. A citrus orchard with dieback symptoms due to CGD.



Fig. 3. Citrus canker lesions on leaves



Fig. 4. Citrus canker lesions on pummelo fruit



Fig 5. Pitting and roping of branches due to CTV infection



Fig. 6. Gummosis infection on citrus trunk



Fig. 7. Scab on kasturi lime



Fig. 8. Pink disease on citrus branches



Fig. 9. Velvet blight on branches



Figs. 10 a & b. Sooty mould on fruit and leaves of honey mandarin



Fig. 11. Greasy spot on leaves