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ICAR- CCRI Advisory on Citrus Greening Disease Management

Citrus greening disease is an important disease of citrus which greatly affects the production of the fruits in several citrus growing states of India. Among all diseases of citrus described to date, citrus greening disease is considered probably the most destructive and lethal. The disease infects citrus trees of almost all cultivars and causes substantial economic losses to the citrus industry. It is estimated that globally more than 60 million trees had been destroyed by the disease. Citrus greening is now known to occur in 40 different Asian, African, South and North American countries and is slowly invading new citrus growing areas. In USA, greening caused about 72% decline in the production of oranges used for juice and other products over the last decade. The presence of greening disease in India was first suspected in 1960s. Thereafter it was reported from different citrus growing regions of India and was considered to be principal cause of citrus dieback and decline. Once a citrus plant is infected in filled, the pathogen remains within as long the plant is alive. Practically, till date, there is no chemical available to control this serious disease.

In the field, the symptoms are often variable and for the most part non-specific. Presence of mineral deficiency symptoms (zinc or iron deficiency) on greening affected trees is the reason why the disease has often been confused with nutritional problems. Emergence of yellow shoot is one of the principal symptom of greening; hence the other name of the disease is Huanglongbing, abbreviated as HLB (Chienese name meaning yellow shoot disease). Leaf blotchy mottle **(Fig. 1)** is one of the best diagnostic symptoms of greening especially in sweet orange group.Trees are sparsely foliated affected by extensive twig die-back and finally decline. Infected fruits are small, misshapen and have a bitter taste, do not colour properly, remaining green on the stylar end (bottom half) of the fruit (Hence the name 'greening') **(Fig. 2)**. Very small fruits are either devoid of seed or contain abortive seeds.

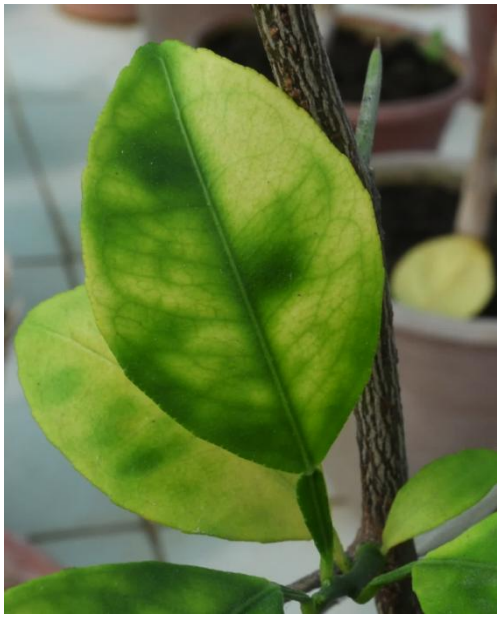

Fig 1. Classic blotchy mottle symptom due to citrus greening disease in Mosambi sweet orange leaf.

Fig 2. Stylar (lower) end greening of Nagpur mandarin fruits

The disease is caused due to a unculturable bacterium , called as *Candidatus* Liberibacter asiatius which inhabit the phloem tissue of infected citrus tree. The bacteria spread through infected planting material from the nursery, and also from one plant to other through an insect pest called as Citrus psylla (*Diaphorina citri*), a vector. It reduces the production and quality of fruit. Ensuring disease-free planting material, control of Citrus Psylla , providing enhanced nutrition and correct water management are the only practical solutions available today for controlling the disease.

Following guidelines may be followed for the successful management of citrus greening disease:

Use of disease-free nursery planting material through budwood cetification programme. Through proper indexing programme greening-free parent trees should be selected for budwood.

Regulatory (quarantine) measures should be strengthened to limit movement, sale and use of infected budwood or nursery stock. Strict control of nurseries through registered disease-free certification scheme is essential to prevent the spread of disease.

Integrated application of Tetracycline hydrochloride 600 ppm (6 g / 10 litres water) + $ZnSO_4$ + $FeSO_4$ (200 g each).Tetracycline hydrochloride should be applied as foliar

spray during winter (December to February) twice at 45 Days interval. $ZnSO_4$ and $FeSO_4$ should be applied in tree basins.

- Since the disease also spreads through the vector, citrus psylla, suitable insecticides should be sprayed to control its spread. Foliar spraying of Insecticides (Thiamethoxam 25 WG 0.3 g/l & after 15 days interval, Imidacloprid 17.8 SL @ 0.5 ml /l) at the time of new flush emergence, for controlling psyllid vector.
- Pruning of symptomatic limbs: Reduction of the inoculum by removal of symptomatic branches/ trees, as the bacterium spreads only slowly throughout the infected tree, removing only the parts of the tree showing symptoms would be useful, depending on the age of the tree and the infection level. Heavily infected trees (showing > 50% canopy symptoms) should be uprooted and destroyed. Tree destruction or pruning must be done when psylla populations are at a minimum, otherwise the disturbance will increase tree to tree spread of both psylla vector and the disease.
- Pruning tools / Secateurs should be disinfected with 1-2% Sodium hypochloride solution after every operation
- Curry leaf tree (*Murraya koenigii*) act as an alternate host for citrus psylla. It should not be grown in the vicinity of the orchard.
- Application of Recommended doses of both micro and macro-nutrient for better tree health and enhanced orchard life.

CCRI Scientists are also trying their best to protect the farmers from the crisis by reaching out to them with available control measures. However, since the bacteria causing the disease has most of the time been present in planting materials itself, control is not as easy as it sounds. In extreme cases, the only solution is to uproot the infested trees. CCRI has also joined hands with other national and international institutes for finding a solution for this disease. With the advent of newer technologies like anti-microbial peptides, nano-zinc oxide, CRISPR approach, developing disease resistant transgenic plant etc., the day seems not far off when we can successfully cure greening infection in oranges.

Dilip Ghosh

(Dilip Ghosh) 3/3/2022