

## Bacterial canker on tomato

*Clavibacter michiganensis* subsp. *michiganensis* (*Cmm*)

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*Cmm* has been detected in seed produced in Indonesia. Incidentally symptoms have been found in the field, although an adequate description of symptoms and symptom development is lacking. *Cmm* is occurring worldwide. *Cmm* is a quarantine pathogen.

### **Symptoms and damage**

Upon infection with *Cmm*, in temperate areas the following symptoms are generally found.

- Systemic wilt of the plant, often starting unilaterally on a (lower) leaf (Fig. 1A) <sup>1</sup>
- Killing of the entire plant from top to bottom, after infection through wounds caused by clipping of terminal buds
- A creamy-white, yellow or reddish-brown discoloration of vascular tissue in stems, petioles and peduncles of wilted plants
- Necrosis of the leaf margin and upward curling of the leaf edges (Fig. 1B)
- Irregular watery spots between leaf veins which become necrotic (dead dry and brownish)

Occasionally the following symptoms are found:

- Pre-emergence death of seedlings (only with highly contaminated seed)
- Adventitious roots on the stems
- Dark streaks on stems and stem cankers (Fig. 1C)
- "Bird's eyes" on fruits: spots with raised brown centers surrounded by an opaque white halo with a diameter of 3-6 mm
- External marbling on fruits
- Yellow vascular areas in fruits leading to the seed

Disease expression is favoured by high humidity, susceptible cultivars, virulent strains of *Cmm*, high inoculum densities, young plant tissue, high temperature (optimum 25 °C) and a high relative humidity. Development of first symptoms

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<sup>1</sup> Symptoms may be confused with bacterial wilt symptoms caused by *Ralstonia solanacearum* (*Rsol*). However, *Rsol* will emerge from cut stems as threads of bacterial ooze if the infected stem is cut in cross-section and suspended in water.

varies between 6 days and 34 days based on the infection density of *Cmm*. Systemic plant infections result in fruit yield reduction of 20-70%

### ***Survival and dissemination***

- In general *Cmm* survives free in soil for only 1 month, but in dry soil much longer survival periods have been reported
- *Cmm* survives for long periods in seed (>1 year)
- *Cmm* can survive > 1 year in infected tomato plant debris.
- *Cmm* can also survive symptomless on a number of weed hosts, in particular solanaceous weeds.
- *Cmm* can be epiphytically present in high densities (< 10<sup>7</sup>)
- *Cmm* is disseminated by splashing water during rain fall and (overhead) irrigation, during clipping transplants, pruning of staked tomatoes
- Insect transmission of *Cmm* has not been reported
- *Cmm* enters via wounds created e.g. during clipping and pruning, via hydathodes and stomata, via wound in roots and by trichomes. One cell is sufficient to establish a successful infection in hydathodes (a contaminated knife can easily infect 30 other plants)
- *Cmm* can be effectively transmitted via nutrient solutions in nutrient film techniques
- *Cmm* is found in guttation droplets supporting large populations of *Cmm* on leaf surfaces of tomato and other solanaceous weeds.
- Systemically infected plants result in general in seed infections with low densities of *Cmm* between 10<sup>2</sup> – 10<sup>5</sup> cells per ml.
- The percentage of seed transmission is reported to range from 0.25 - 100%.

### ***Prevention and cure***

- Use certified pathogen-free seed and transplants
- Use seed disinfected with diluted hydrochloric acid (HCl) or other disinfecting compounds
- Heat-sterilize potting media for transplants. Sterilize equipment and materials with a 1% bleach solution. Disinfect clippers during pruning between plantings and rows
- Do not dip transplants in crates or boxes in water, which will efficiently disseminate *Cmm*
- Produce seed in isolated areas, not near to tomato production fields
- Preferably do not enter fields if the foliage is wet
- Do not use overhead irrigation
- Contact an official (seed health inspector?) if (suspected) symptomatic plants are found. Consider all plants and seeds produced at the location to be contaminated. Remove diseased plants and put them immediately in a plastic bag

- Disinfect anything which has come in contact with infected plant material before entering a tomato crop again. Wash clothes at high temperatures. Use bleach for equipment and machineries
- Treatments with bactericides (e.g. streptomycin, copper), compounds inducing plant resistance (e.g. Actigard), antagonists (e.g. avirulent *Cmm* populations) or use of resistant varieties can limit *Cmm* populations and disease progress but will not eliminate the disease
- Burn infected plant tissue or incorporate infected plants in the soil for decomposition
- Disinfect soil by soil solarization  
A 4-6 weeks treatment of 30-50 °C will reduce *Cmm* in top soil (<15 cm)
- A three-years rotation with crops known as non-hosts for *Cmm* is encouraged

Fig. 1A Systemic wilt



1B. Necrosis of leaf margin and upward curling of the leaf edges



1C Dark streaks and stem cankers

