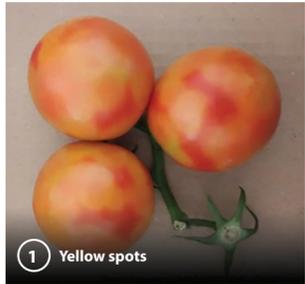


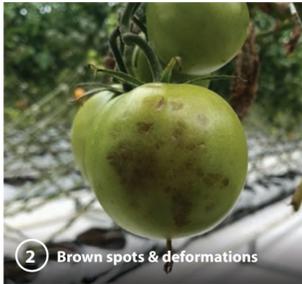
Tomato brown rugose fruit virus (*ToBRFV*) and Pepino mosaic virus (*PepMV*)

! KEY ADVICE:

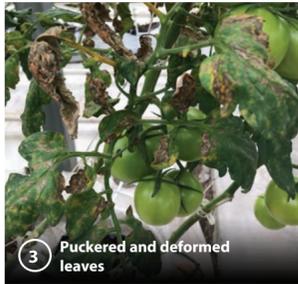
- o Vigilance – ensure all staff are aware of the symptoms and report anything unusual.
- o Establish good hygiene practices and processes. **START CLEAN – STAY CLEAN.**
- o Limit visitor access.
- o If something looks wrong, report to MPI 0800 80 99 66 and get it tested.



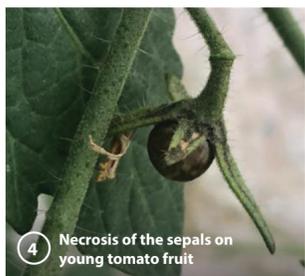
1 Yellow spots



2 Brown spots & deformations



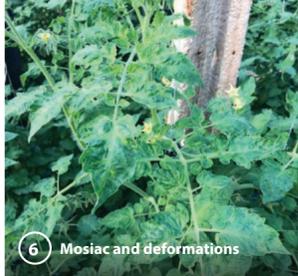
3 Puckered and deformed leaves



4 Necrosis of the sepals on young tomato fruit



5 Marbling & discoloration



6 Mosaic and deformations



7 Wilting symptoms



8 Symptoms on tomato leaves



9 Mosaic on tomato leaves

Tomato brown rugose fruit virus (*ToBRFV*)

What is tomato brown rugose fruit virus?

Tomato brown rugose fruit virus (ToBRFV) is a member of the Tobamovirus genus. Tomatoes and capsicum are the main hosts. Petunia and certain weeds like black nightshade and goosefoot have been shown to be hosts in experiments and may act as reservoirs for ToBRFV. **ToBRFV is not present in New Zealand.**

What does it look like?

Symptoms on tomato fruits include yellow spotting and discoloration, green spots and deformations, green grooves and irregular brown spots and wrinkled (rugose) patches. Fruits may be deformed and have irregular maturation. On tomato leaves, ToBRFV symptoms appear as mosaic symptoms, spots and yellowing. Leaves can also appear narrowed, puckered and deformed.

Why is it important?

Tomatoes are a primary host of ToBRFV. Crop production and tomato quality are affected, significantly impacting market value and can cause large crop loss. ToBRFV may affect export market access.

How does it spread?

ToBRFV can be easily transmitted by mechanical means in crop operations such as pinching out, twisting and harvesting, but also by infected items such as knives, pruners, clothing, jewellery and containers. It can also be spread by insects in the greenhouse such as bumblebees, as well as via contact with infected fruits and plant material.

The virus can survive in water, soil, plant material residues and host plant seeds, as well as in the ground. Tobamovirus particles can remain infective in seeds, crop debris and contaminated soil, on tools, stakes, trellis wires, containers, greenhouse benches, and seedling trays for months to years.

Volunteer crop plants and solanaceous weed species can serve as pathogen reservoirs. Tobamoviruses are very persistent and can last for a long-time on host plants, and survive on inert materials (clothing, tools), in plant remains, in substrate and in soil without losing their virulence.

Pepino mosaic virus (*PepMV*)

What is pepino mosaic virus?

Pepino mosaic virus (PepMV) is a disease of greenhouse tomatoes as well as other solanaceous crops (e.g. potatoes and eggplants).

What does it look like?

Symptoms appear 2–3 weeks after infection and tend to spread along the row. Affected plants can show stunting of the growing point of the plant or damage resembling hormonal herbicide damage. Leaves around the 'head' of the plant may show dark spots and significant distortion while lower leaves may have brown, necrotic lesions. Other leaf symptoms may be yellow spots which later develop into bright yellow patches on the leaf and 'bubbling' on the leaf surface.

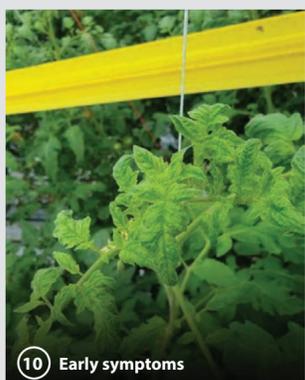
Symptoms observed on infected fruits have been described as 'marbled' and may be more readily seen in red beef varieties.

Why is it important?

PepMV infection does not always result in significant economic impact since fruit symptoms may be absent. It has been suggested that yield may be affected and fruit setting may be delayed. When present it is easily transmitted by mechanical contact.

How does it spread?

PepMV is spread by seed, stalks and leaves and very easily through mechanical contact including contaminated tools, hands, clothing, direct plant-to-plant contact, and propagation. Bumblebees used as pollinators are also known to spread the disease.



10 Early symptoms



11 Advanced symptoms



12 Leaf blistering



13 PepMV leaf symptoms



14 PepMV leaf symptoms



15 PepMV leaf symptoms

What can I do at my greenhouse?

Strict hygiene measures are the only way to prevent an infection, and minimise spread. Set up and follow a greenhouse hygiene and disinfection protocol for staff and visitors, and minimise who can go into the greenhouse. For detailed advice on steps you can take read the "Greenhouse hygiene measures" poster issued by TomatoesNZ and refer to the **covered crop biosecurity guide**.

Who can I contact for more information?

TomatoesNZ has a fact sheet and a detailed grower information sheet on Tomato brown rugose fruit virus and Pepino mosaic virus. Contact us on 0508 467 869 or download from www.tomatoesnz.co.nz/biosecurity/

If you think something looks wrong in your greenhouse please contact MPI on 0800 80 99 66.

Photos: (1) Typical fruit symptoms with yellow spots. Courtesy: Dr Aviv Dombrovsky. (2) Symptoms on tomato fruits. Courtesy: Diana Godinez. (3) Typical fruit symptoms with yellow spots. Courtesy: Dr Aviv Dombrovsky. (4) Necrosis of the sepals on young tomato fruit. Courtesy: Prof. Salvatore Davino. (5) Tomato fruits showing marbling and decoloration. Courtesy: Prof. Salvatore Davino. (6) Mosaic on tomato leaves (Sicily, Italy, January 2019). Courtesy: Prof. Salvatore Davino. (7) Wilting symptoms under glasshouse conditions (Germany, 2018) Courtesy: Heike Scholz-Döbelin (LWK NRW). (8) Typical fruit symptoms with yellow spots. Courtesy: Dr Aviv Dombrovsky. (9) Symptoms on young leaves (Israel, 2019). Courtesy: Camille PICARD (EPPO). (10) Early symptoms of PepMV. Courtesy: TNZ. (11) Advanced symptoms of PepMV. Courtesy: TNZ. (12) Leaf blistering. Courtesy: gd.ippo.int. (13) PepMV leaf symptoms. Courtesy: Biobest. (14) PepMV leaf symptoms. Courtesy: Symptomen-pepinomozaïekvirus. (15) PepMV leaf symptoms. Courtesy: Symptomen-pepinomozaïekvirus.