



Tomato Brown Rugose Fruit Virus

Commitment of the European Seed Industry to help manage risk from ToBRFV

Euroseeds, section Vegetable and Ornamental crops (SVO), is aware that outbreaks of Tomato Brown Rugose Fruit Virus (ToBRFV) have been reported in multiple countries where this Tobamo virus causes major concerns in tomato and capsicum production.

This document, elaborated by seed experts on the topic of Tomato Brown Rugose Fruit Virus (ToBRFV), is for informational purposes only. It is aimed at describing some key measures to implement in production sites in order to prevent and minimize the risks of introduction and spread of ToBRFV.

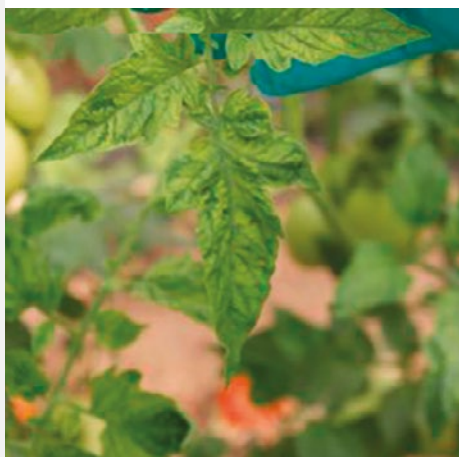
1) What is Tomato Brown Rugose Fruit Virus (ToBRFV)?

- Tomato Brown Rugose Fruit Virus (ToBRFV) is a pathogen that can infect tomatoes (*Solanum lycopersicum*) and pepper (*Capsicum* sp.). Tomato is the main crop impacted by ToBRFV. The virus is problematic, as it has the ability to overcome all known genetic tobamovirus resistances and cause severe fruit symptoms.

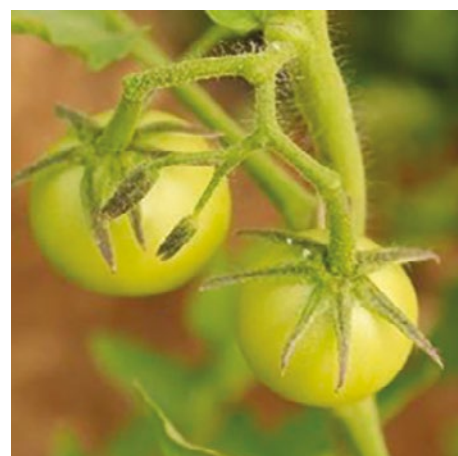
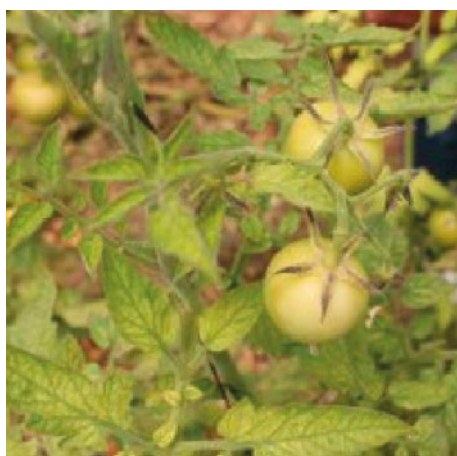
2) What do the symptoms look like

- The symptoms of ToBRFV resemble those that occur from ToMV infection of a susceptible tomato variety. Infected plants can develop symptoms on leaves, fruit calyx and the fruit itself. This virus which belongs to the same tobamovirus group (e.g. TMV, ToMV) behaves very similar to others within this group. The one exception is that, symptoms occur on previously known tobamovirus resistant varieties and symptoms may be much more severe, especially on the fruit. Symptom expression of plants infected with this tobamovirus may vary according to environmental and growing conditions, especially light and temperature.

● **LEAF:** Symptoms caused by of this virus are mosaic with leaf distortion (bubbling) and shoestring, and fern leaf.



● **CALYX:** Calyx symptoms include distinct discoloration (browning) of the veins of the calyx in an early stage of the fruit development or drying out and browning of the end of the calyx tips.



● **FRUIT:** Plants infected by this virus may produce undersize fruits with a rough surface or complete fruit abortion may occur. Fruit coloration is affected with symptoms occurring as blotching, pale color and/or brown necrotic spots. The number of fruits produced is reduced and fruits could be unmarketable or reduced in quality.















3) *Transmission and risks*








- In both tomato and pepper the virus can be spread easily from plant to plant. Therefore, caution is advised to avoid the possible virus transfer from tomato to pepper plants (and vice versa), between plants within the same production system, and special care needs to be taken in transplant situations or in crop production systems where plants are regularly visited and handled.
- Tobamoviruses can survive for long periods in infected crop debris, in the soil or on contaminated surfaces.
- On surfaces such as a bench tops, survival could be weeks to months and in infected plant debris, survival can be as long as the infected debris remains intact.
- Spread of the virus can occur very readily by mechanical transfer, especially in protected or high input culture systems where plants are pruned, staked, handled and touched frequently. In open field productions machinery used for cultivation or weed control can spread viruses from plants to plants, but an important risk of contamination often underestimated is irrigation water.
- Symptoms of the disease impact the commercialization of the fruits, with economic consequences for the producer. Tomato and capsicum are important crops grown under protected conditions. Once the virus is present in an area, strict hygiene measures and elimination of the infected plants are necessary.

4) *Measures to implement to prevent the introduction and the spread of Tomato Brown Rugose Fruit Virus (ToBRFV)?*

- **Hygiene best practice** procedures should be applied as a precautionary measure to prevent the introduction of ToBRFV and minimise the impact of an outbreak should one occur. No chemical can be used to cure infected plants.
- As the virus is primarily transmitted via contact, a suite of prophylactic measures termed 'hygiene best practice' should be followed to minimise the chances of the virus entering and spreading within a crop. These precautions should be applied routinely.
- This list is not exhaustive but provides an overview of measures recommended to minimise the risk of spread of contact-transmitted pathogens including other viruses and viroids.



Recommendations for people WORKING in the plant growing area	Recommendations for people VISITING the plant growing area	
	Use seeds that have been tested as “free from ToBRFV” by an officially recognised method	N/A
	Be aware that the use of cuttings can be a serious factor of disease spreading	
	Be trained by phytosanitary experts on how to act related to putting on personal protection equipment (coats, gloves, hairnets, overshoes, etc.) as well as identifying symptoms and diseases and sampling for detection of diseases (cross contamination of samples is highly likely if not properly trained)	
	N/A	As seed representative, plan carefully your day for visiting clients, visit plant raisers at the beginning of the day and visit growers in the order of known information of being free of pest to partially contaminated to fully contaminated. Avoid visiting multiple greenhouses per day. Avoid visiting plant raisers during plant-raising phase
	Never park your car nearby the growing zone	
	Use disinfectant mats that should be placed at each entrance. Disinfectant mats are also meant to be used by passing machinery. Make sure the disinfectant is always effective	Put on NOT ALREADY USED disposable: Coverall coat, Gloves, Shoes cover, Head cap, etc.
	Allow only the necessary people to enter the place of production or join the visit	Visit the growing areas only when absolutely necessary
	Wash hands with soap on arrival and departure from the production site and between the business units (greenhouse, canteen, toilets, etc). Disinfect hands using whenever at disposal strategically placed disinfectant dispensers at all entrances	
	Avoid bringing jewellery, watches and phones in production areas. Clean glasses with alcohol tissues between visits	
	Ensure that anyone entering the place of production wear clean clothing, new or disinfected coveralls, new or disinfected boots and gloves. Alternatively, the use of disposable overalls, gowns and gloves is recommended. Make sure you have always at your disposal and for people under your responsibility enough personal protection equipment	Put on NOT ALREADY USED disposable: - Coverall coat - Gloves - Shoes cover - Head cap etc.
	N/A	Stay in the aisles if it's not necessary to go into the growing area
	Inspect the plants regularly. If symptomatic plants are discovered, eliminate all plants within a minimum of 1.5 meters beyond the outermost infected plant. All containers that hosted infested plants must be sterilized or destroyed. All infested plants, debris and contaminated substrate shall be removed and incinerated	Inform immediately the staff of the growing area if you observe a plant with symptoms or abnormal characteristics

Recommendations for people VISITING the plant growing area	Recommendations for people VISITING the plant growing area
 <p>Do not touch any plants or fruits without wearing gloves and only when it is absolutely necessary. If a plant seems abnormal, remove it from the growing area, but change gloves just after having touched it</p>	<p>Do not touch any plants or fruits without wearing gloves and only when it is absolutely necessary</p>
	<p>Never bring with you and within your car any part of plant nor fruit if it is not hermetically sealed in a plastic bag which that will be opened only under controlled and sanitized conditions by trained people in a lab</p>
	<p>Do not use your personal devices inside the growing area. If you have to do so, the whole device has to be carefully disinfected before exiting it outside</p> <p>Do not use your mobile phone, lab top, pens, notebook, etc in production areas. If you need to use them (to take pictures of symptoms for example or write down notes), be aware to not contaminate them with virus if you have already touched plants. If you bring your phone with you at the production place put it in the pocket of your disposable coverall and not in your clothes. Disinfect your phone and other used material in the anti-chamber before putting it back in your clothes. Every element that has been introduced with you in the place of production shall be fully disinfected</p>
	<p>Follow good hygiene practices by recommending to clean work booths with disinfectants and to sanitize tool</p> <p>Follow good hygiene practices by recommending to clean and to sanitize everything you bring with you inside the growing area</p>
	<p>Do not bring anything outside which could come from the inside growing area</p> <p>When taking samples, be extremely careful and use double bagging of the samples in order to be able to disinfect the outside of the packing</p>
	<p>Pull off gloves from wrist upwards so the glove ends up inside out. Pack clothing in a hermetic bag before exit, to bring it for washing (or to throw away if it is disposable clothes). Make sure the disposable clothing is indeed being discarded in the appropriate waste bin for immediate destruction</p>
	<p>Make people aware of the importance of good hygiene practice</p>

Euroseeds, section Vegetable and Ornamental crops (SVO), is committed to supply clean high-quality seeds to their customers and to implement the most appropriate measures and lab tests to mitigate the risks of introduction and spread of Tobamoviruses such as Tomato Brown Rugose Fruit Virus (ToBRFV). At any visit to other stakeholders e.g. growers or nurseries, representatives of vegetable seed companies will take appropriate measures to lower the risk of pest spreading. This document, elaborated by seed experts on the topic of Tomato Brown Rugose Fruit Virus (ToBRFV), is for informational purposes only. It is aimed at describing measures implemented by seed companies to prevent and minimize the risks of introduction and spread of ToBRFV.