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Pest survey card on Tomato brown rugose fruit virus

European Food Safety Authority (EFSA)

Abstract

This document provides the conclusions of the pest survey card that was prepared in the context of the EFSA mandate on plant pest surveillance (M-2020-0114) at the request of the European Commission. The full pest survey card for Tomato brown rugose fruit virus (ToBRFV) is published and available online in the EFSA Plant Pest Survey Cards Gallery at the following link and will be updated whenever new information becomes available:
<https://efsa.europa.eu/plants/planthealth/monitoring/surveillance/tomato-brown-rugose-fruit-virus>

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Keywords: delimiting survey, detection survey, European Union quarantine pest, pepper, risk-based surveillance, tomato, Tomato brown rugose fruit virus

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1. Introduction

This pest survey card was prepared in the context of the EFSA mandate on plant pest surveillance (M-2020-0114), at the request of the European Commission. Its purpose is to guide the Member States in preparing data and information for Tomato brown rugose fruit virus (ToBRFV) surveys. These are required to design statistically sound and risk-based pest surveys, in line with current international standards. ToBRFV is a clearly defined taxonomic entity. It is regulated by the emergency measures in Commission Implementing Regulation (EU) 2020/1191, and has been reported in Asia, North America and Europe. ToBRFV systemically infects its host plants and can maintain its viability even outside of its host plants. The main transmission mechanism for ToBRFV is mechanical, during seed germination or mediated by pollinators and/or agricultural practices. The survival time of the virus outside its host remains uncertain. ToBRFV can naturally infect tomato (*Solanum lycopersicum*) and susceptible peppers (*Capsicum annuum* and *C. chinense*), however, experimental infections have been reported in other families, such as Solanaceae, Amaranthaceae, Apocynaceae and Asteraceae. The host plants to include in the detection surveys in the EU should be *S. lycopersicum* and susceptible *C. annuum*, whereas experimental hosts could be included in delimiting surveys. ToBRFV is expected to be able to establish in all areas in the EU where hosts are present in either protected or field conditions. ToBRFV spreads through the movement of infected seeds, plants for planting, fruits, flight of pollinators and agricultural practices. ToBRFV can induce a wide range of symptoms on tomato and pepper plants and fruits. Symptoms may be confused with those induced by other viruses, but infections can be asymptomatic. Therefore, visual examination of symptoms is not sufficient for the detection and identification of ToBRFV, and its presence must be confirmed by sampling and molecular identification.

2. The survey preparation

Table 1 addresses the key questions that are relevant for preparing a pest survey. First, the plant pest needs to be characterised in terms of its life cycle and biology. Then, the structure and size of the target population needs to be characterised and these analyses should be tailored to the situation in each Member State. Figure 1 gives examples of the components of a target population for Tomato brown rugose fruit virus and is not necessarily exhaustive. Finally, the detection process needs to be characterised in terms of the sequence of detection and identification methods required for the survey.

Table 1: Preparation of surveys for ToBRFV

Survey question	Section	Key information
What?	1. The pest and its biology	ToBRFV can naturally infect systemically tomato (<i>S. lycopersicum</i>) and susceptible pepper (<i>C. annuum</i> and <i>C. chinense</i>).
Where?	2. Target population	Epidemiological units: homogeneous areas that contain at least one individual host plant of tomato (<i>S. lycopersicum</i>) or susceptible pepper (<i>C. annuum</i> and <i>C. chinense</i> , if present).
		Risk areas: areas where ToBRFV host plants are cultivated around risk locations (e.g., nurseries, garden centres and warehouses where hosts of ToBRFV are imported, traded or stored from areas where ToBRFV is known to occur; commercial facilities and packing stations that process and pack host fruits from diverse origins; waste fruit disposal locations such as tomato and pepper processing facilities and disposal of host debris following harvesting).
		Inspection units: individual host plants (e.g., pepper or tomato plant).

How?	3. Detection and identification	Visual examination of symptoms alone is not sufficient for the detection and identification of ToBRFV and should be combined with sampling and molecular protocols of diagnostics. Laboratory testing can be conducted on seeds, leaves and fruits and taking into consideration the diagnostic sensitivity of the molecular test chosen. Sampling of young leaves from the top of plant or sepals is recommended.
When?		Tomato and pepper crops can be cultivated either in open field or in greenhouses, therefore the availability of plant material to be collected for sampling will vary accordingly.

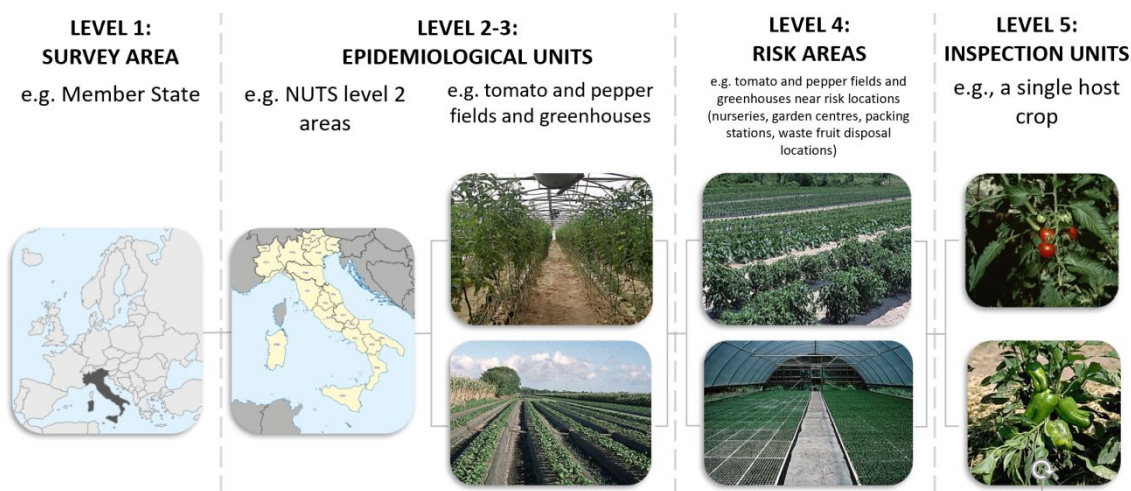


Figure 1: Example of the hierarchical structure of the target population for ToBRFV in the EU (Sources: Eurostat, 2018 (levels 1 and 2); Melanie Camilleri (level 3, top); David Riley, University of Georgia, Bugwood.org (level 3, bottom); Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org) (level 4, top and bottom); USDA APHIS PPQ – Oxford, North Carolina, USDA APHIS PPQ, Bugwood.org (level 5, top); Howard F. Schwartz, Colorado State University, Bugwood.org (level 5, bottom))

3. From survey preparation to survey design

Figure 2 shows the next steps after the survey preparation for designing statistically sound and risk-based detection and delimiting surveys of ToBRFV. Guidance on the selection of type of survey, related survey preparation and design, is provided in the EFSA general guidelines for pest surveys¹.

¹ EFSA (European Food Safety Authority), Lázaro E, Parnell S, Vicent Civera A, Schans J, Schenk M, Cortiñas Abrahantes J, Zancanaro G and Vos S, 2020. General guidelines for statistically sound and risk-based surveys of plant pests. EFSA supporting publication 2020:EN-1919, 65 pp. doi: 10.2903/sp.efsa.2020.EN-1919

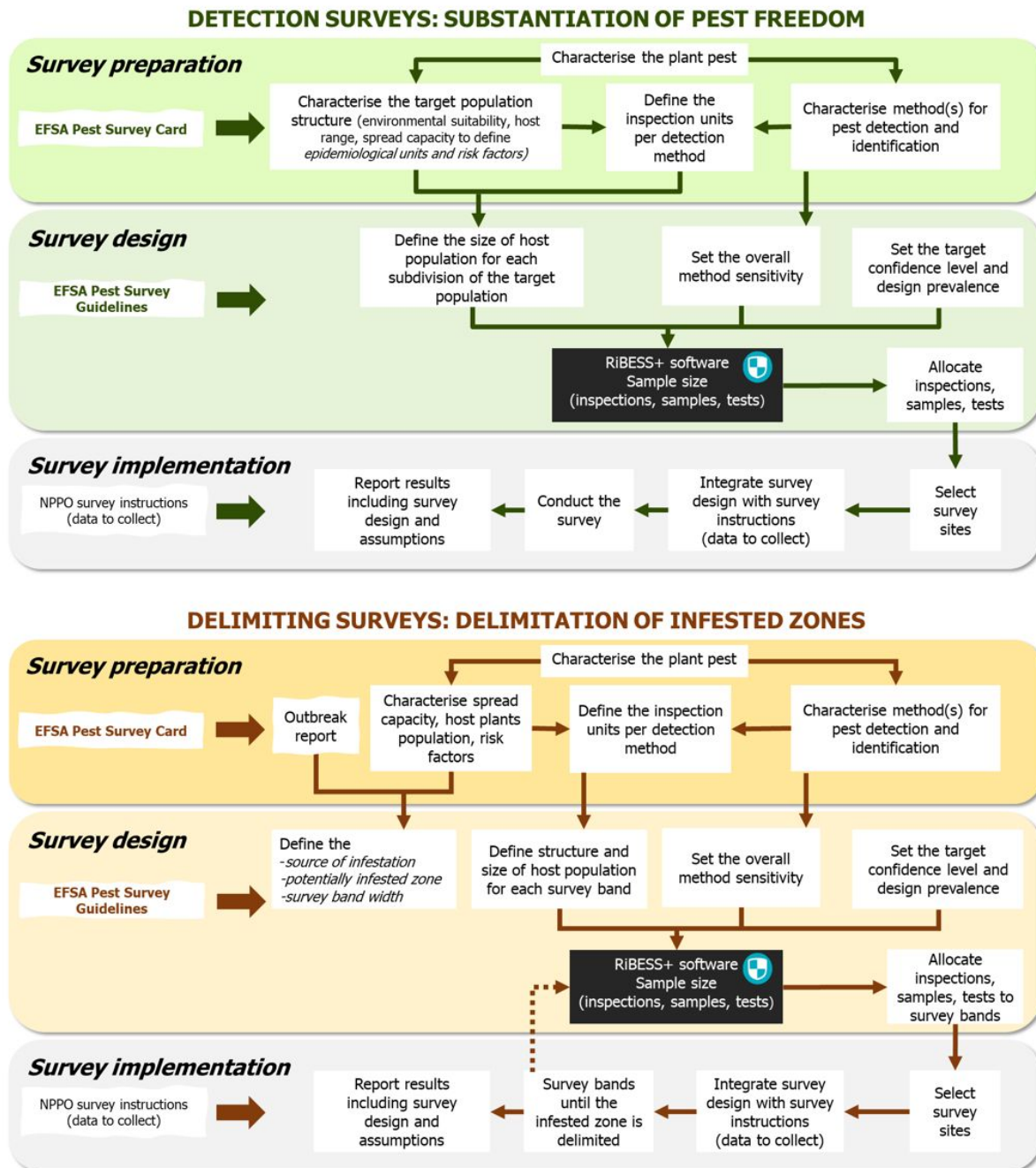


Figure 2: Steps required for the preparation, design and implementation of detection and delimiting surveys, according to the methodology for statistically sound and risk-based surveillance¹

Relevant EFSA outputs

- General guidelines for statistically sound and risk-based surveys of plant pests: <https://efsa.onlinelibrary.wiley.com/doi/10.2903/sp.efsa.2020.EN-1919>
- Pest survey card on Tomato brown rugose fruit virus: <https://efsa.europa.eu/plants/planthealth/monitoring/surveillance/tomato-brown-rugose-fruit-virus>
- Index of the EFSA Plant Pest Survey Toolkit: <https://efsa.europa.eu/plants/planthealth/monitoring/surveillance/index>
- Plant pest survey cards gallery: <https://efsa.europa.eu/plants/planthealth/monitoring/surveillance/gallery>
- Pest survey cards: what, when, where and how to survey? <https://www.youtube.com/watch?v=kHANmRDex8>
- The statistical tool RiBESS+: <https://r4eu.efsa.europa.eu/app/ribess>
- The RiBESS+ manual: <https://zenodo.org/record/2541541#.YkrgRyhByUm>
- The RiBESS+ video tutorial: <https://youtu.be/qYHqrCiMxDY>