

Tomato brown rugose fruit virus contaminated clothing of greenhouse employees is a challenge for cleaning



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BACKGROUND

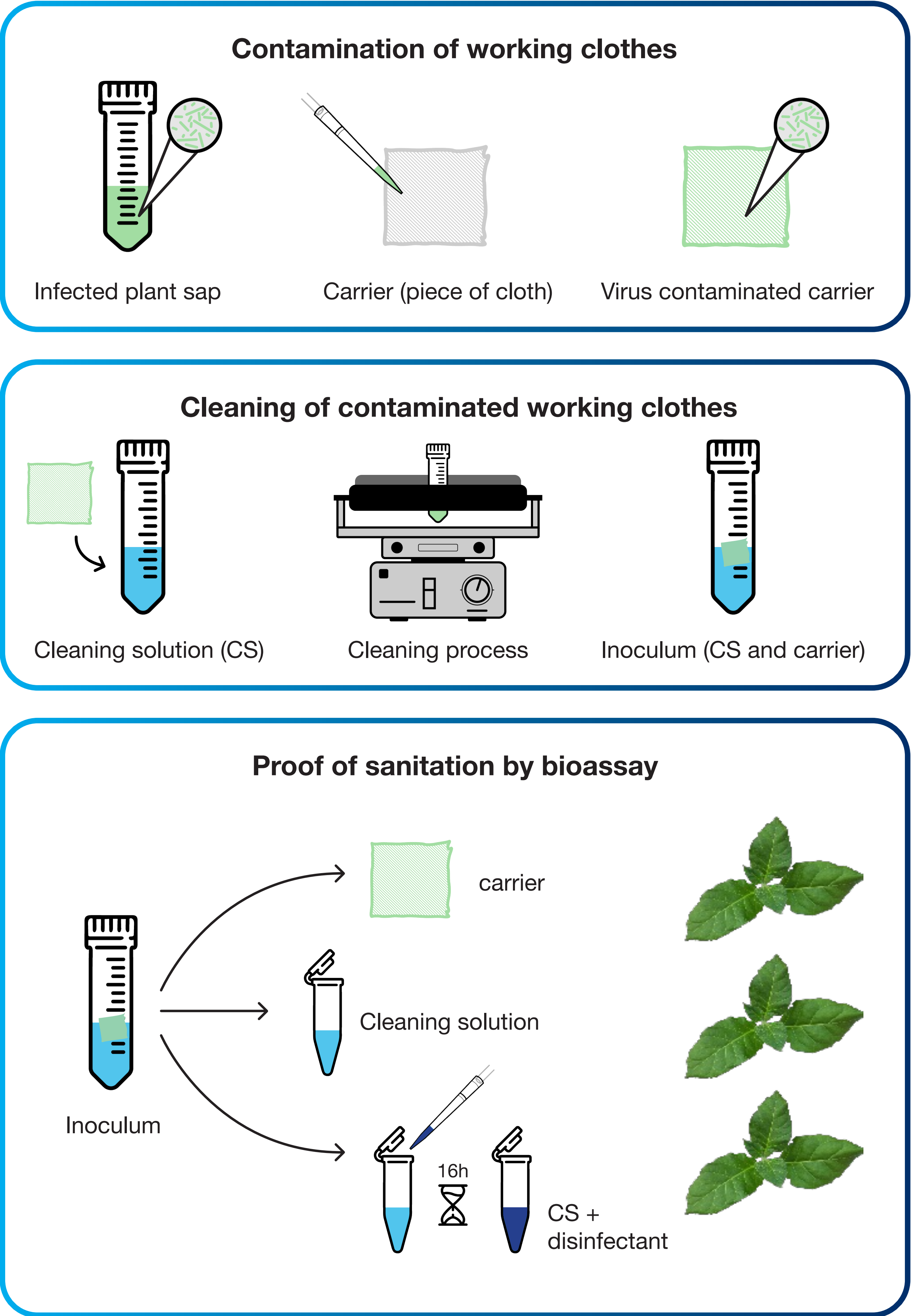
The multiple outbreaks of *Tomato brown rugose fruit virus* (ToBRFV) across countries of major importance for tomato production (EPPO, 2022), which are followed by high economic losses (Avni et al., 2019), highlight the stable tobamovirus as one of the major threats to global tomato production. Once it has reached the crop, the easy mechanical transmissibility facilitated by culture measures leads to the infection of all host plants within a very short time (González-Concha et al., 2021). Due to the disease symptoms of ToBRFV on the fruit, many tomatoes are no longer marketable (Menzel et al., 2019). Experiences from recent ToBRFV outbreaks in Germany indicate that **losses of well over 50%** are possible, depending on the time of infection and the cultivated tomato variety. Based on this high damage potential, ToBRFV is regulated in many regions and is under official eradication measures. Since there are no curative crop protectants available post-viral infection, interruption of all transmission pathways is crucial. This includes cleaning and disinfection of seeds, tools, shoes, gloves and **clothing**. In this context, we investigated whether clothing contributes to the spread of ToBRFV and how it can be successfully cleaned. For this study, bioassays (Nourinejhad et al., 2022) were conducted which were serologically confirmed by subsequent DAS-ELISA testing (RT-1236, DSMZ).



RECOMMENDATIONS FOR PRACTICAL IMPLEMENTATION

- Pre-cleaning of potentially ToBRFV-contaminated clothes in „washing tube“ in either Menno Florades, Menno Hortisept Clean Plus and Fadex H⁺ at 10 min, room temperature
- Afterwards conventional cleaning of the precleaned clothes in household washing machine
- Addition of Menno Florades (4 %) for a contact time of 16 h to the contaminated cleaning solution

EXPERIMENTAL DESIGN



Classification	Trade name	Tested conc.	Reliable cleaning of clothing?	Are cleaning solutions a risk?	Does disinfection by Menno Florades work?
Household laundry products	Spee ActivGel	0.25%	✗	✓	✓
	Vanish Oxi Action Gel	2.5%	✗	✓	✓
Agricultural detergents	Fadex H ⁺	2%	✓	✗	✓
	Hortisept Clean Plus	2%	✓	✗	✓
Disinfectant (plant protectant)	Menno Florades	4%	✓	✗	✓

Literature

Avni, B.; Gelbart, D.; Sufrin-Ringwald, T.; Zinger, A.; Chen, L.; Machbash, Z.; Bekelman, I.; Segoli, M.; Dombrovsky, A.; Kamenetsky, R. Tomato genetic resistance to tobamoviruses is compromised. In Proceedings of the VI International Symposium on Tomato Diseases: Managing Tomato Diseases in the Face of Globalization and Climate Change 1316, 2019; pp. 89-98.

Ehlers, J.; Nourinejhad Zarghani, S.; Kroschewski, B.; Büttner, C.; Bandte, M. Cleaning of Tomato brown rugose fruit virus (ToBRFV) from Contaminated Clothing of Greenhouse Employees. *Horticulturae* 2022, 8, 751. <https://doi.org/10.3390/horticulturae8080751>

EPPO. 2022: Tomato brown rugose fruit virus. Distribution. Available online: <https://gd.eppo.int/taxon/TOBRFV/distribution>. (accessed on 12-12-2022).

González-Concha, L.F.; Ramírez-Gil, J.G.; García-Estrada, R.S.; Rebollar-Alviter, A.; Tovar-Pedraza, J.M. Spatiotemporal analyses of tomato brown rugose fruit virus in commercial tomato greenhouses. *Agronomy* 2021, 11, 1268, doi: <https://doi.org/10.3390/agronomy11071268>.

Menzel, W.; Knierim, D.; Winter, S.; Hamacher, J.; Heupel, M. First report of tomato brown rugose fruit virus infecting tomato in Germany. *New Disease Reports* 2019, 39, 1-1, doi: <https://doi.org/10.5197/j.2044-0588.2019.039.001>.

Nourinejhad Zarghani, S.; Monavari, M.; Ehlers, J.; Hamacher, J.; Büttner, C.; Bandte, M. Comparison of Models for Quantification of Tomato Brown Rugose Fruit Virus Based on a Bioassay Using a Local Lesion Host. *Plants* 2022, 11, 3443. <https://doi.org/10.3390/plants11243443>

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For further
Information
please see:



Ehlers et al., 2022