



Using open-source resistance to ToBRFV in participatory tomato breeding in Austria

Helene Maierhofer (ARCHE NOAH) - 24.5.2026 Scandicci

Variety Development in ARCHE NOAH



Philipp Lammer



Helene Maierhofer



Andreas Rohmert

Participative breeding in Austria



ARCHE NOAH coordinates
two breeding networks :

- **Bauernparadeiser**
- SamenTräger:innen

→ **breed** open-pollinated, disease resistant, productive **varieties** for **organic production** and for **homegardeners**

→ **make seeds available** for the organic growers and the seed community

- **15 farms and 2-3** research stations
- **ARCHE NOAH** as coordinator



**BAUERN
PARADEISER**

Samenfeste Vielfalt aus bäuerlicher Züchtung

Focus breeding programs of tomato

Beef and slicing tomatoes for protected cultivation

Quality:

- Intense flavour
- Few green inclusions – even inner fruit colouring
- Attractive fruits

Yield:

- High and even fruit set = long harvest window
- High percentage of marketable fruits

Resistances:

- Ff – *Fulvia fulva*
- Va/Vd – *Verticillium* sp. + Fol – *Fusarium* sp.
- ToMV – Tomato Mosaic Virus
- **ToBRFV?**



Large cluster

Bronski



Perfectly balanced, labor-friendly plant type with the strongest setting capacity, and tasty, firm, shiny red fruits.

Fruit weight: 140-160 grams.

Resistances: HR: ToMV:0-2/**ToBRFV**/Pf:A-E/Fol:0,1
IR: TSWV/On



Bronski

Rhodium



Generative plant type with a very strong setting capacity, labour friendly and high tasteful shiny red firm fruits.

Fruit weight: 140-160 grams.

Resistances: HR: ToMV:0-2/**ToBRFV**/Pf:A-E/Va:0/Vd:0/Fol:0,1
IR: TSWV/On



Rhodium

Calleza (E15M.43412)



Cluster variety which can be pruned on 6 with high average fruit weight of 130-150 grams.

Fruit weight: 130-150 grams.

Resistances: HR: ToMV:0-2/**ToBRFV**/Pf:A-E/Fol:0,1/For
IR: On/Ma/Mi/Mj



Calleza

E15M.43489



Very generative planttype with a high production potential, dark red fruits and a shorter plant active length.

Fruit weight: 130-150 grams.

Resistances: HR: ToMV:0-2/**ToBRFV**/Pf:A-E/Va:0/Vd:0/Fol:0,1/For
IR: On

<https://webkiosk.enzazaden.com/catalogue-tomato-heated-west-europe-2026/68475197>

Patent applications on ToBRFV-resistance 2018 - 2023



Company	Number of patent application
Vilmorin	WO2018219941
Rijk Zwaan	WO2019110130
Rijk Zwaan	WO2019110821
Seminis	WO2020018783
Enza Zaden	WO2020148021
Vilmorin	WO2020249996
Vilmorin	WO2020249798
Rijk Zwaan	WO2021110855
National Agriculture and Food Research Organisation, Japan	WO2021161615
Rijk Zwaan	WO2021170868
BASF/Nunhems	WO2021213892
Vilmorin	WO2021245282
Rijk Zwaan	WO2022013452
Philoseed	WO2022018734
Tomatech	WO2022234584
Vilmorin	WO2022117884
Volcano Institute /State of Israel	WO2022091104
Volcano Institute /State of Israel	WO2023095144
Rijk Zwaan	WO2023135335
Syngenta	WO2023156569
Philoseed	WO2023144828
Syngenta / Nunhems/ Rik Zwaan / Takii	WO2023194291

Table overview:

Patent applications for resistance to Tomato Brown Rugose Fruit Virus (ToBRFV or TBRFV) claiming genetic resources (gene, plants, seeds), with and without genetic engineering (2018-2023). The relevant gene variants were found in existing plants, further examples of random mutagenesis and genetic engineering were added as technical toppings, but are not necessary.



Source: No Patents On Seeds (2024) How patents block the breeding of tomatoes resistant to the harmful Tomato Brown Rugose Fruit Virus
https://www.no-patents-on-seeds.org/sites/default/files/news/2024-04%20Patents%20on%20TBRFV-Virus_0.pdf

Article

Identification and Mapping of Tomato Genome Loci Controlling Tolerance and Resistance to *Tomato Brown Rugose Fruit Virus*

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Possible to use this resistance?



Agricultural Research Organization
Ministry of Agriculture and Rural Development
The Volcani Center
Israel



- Two resistant/tolerant lines
- **nonexclusive license** for use of the lines for breeding
- License fee of **100,000 USD**

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Article

Evaluation of Tomato Germplasm against Tomato Brown Rugose Fruit Virus and Identification of Resistance in *Solanum pimpinellifolium*

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4 accessions
with resistance to
ToBRFV



Possible to use this resistance?



United States Department of Agriculture (USDA) /
Agricultural Research Service (ARS)



University of Arkansas

- **Materials are open-sources without patent protection**
- The paper describing QTL for the resistance to ToBRFV using these materials was published
 - 4 accessions ordered via Germplasm Resources Information Network (GRIN)
 - Free of charge



Contents lists available at [ScienceDirect](#)

Scientia Horticulturae

journal homepage: www.elsevier.com/locate/scihorti



Research Paper

Deciphering resistance to Tomato brown rugose fruit virus (ToBRFV) using Genome-Wide Association Studies



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3 (+2) accessions
with tolerance to ToBRFV



Published: 14 January 2025
<https://doi.org/10.1016/j.scienta.2025.113968>

Possible to use this resistance?



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Institute of Plant Breeding, Genetics and Genomics, University of Georgia, Athens, GA 30602, USA



Cornell University, Ithaca, New York, USA

- **Possible to use the accessions since they are publicly available and disclosed as resistant**

→ 3 accessions were ordered from TGRC (Tomato Genetics Resource Center)

→ Costs: 145 \$ (128 €)

2026: Pilot inoculation tests with ToBRFV



2026: Pilot inoculation tests with ToBRFV



susceptible



resistant



2027: Plant per plant resistance tests + first crossings



Species	Resistance	Reference	DOI
S. pimpinellifolium	HR	Jaiswal 2024	https://doi.org/10.3390/plants13050581
S. pimpinellifolium	HR	Jaiswal 2024	https://doi.org/10.3390/plants13050581
S. pimpinellifolium	IR	Topcu 2025	https://doi.org/10.1016/j.scienta.2025.113968
S. pimpinellifolium	IR	Topcu 2025	https://doi.org/10.1016/j.scienta.2025.113968
S. habrochaites	HR	Jewehan 2022	https://doi.org/10.1007/s10327-022-01055-8





Thank you for your attention!

How do you deal with patents in your breeding programs?

Are you a tomato breeder and would like to cooperate with us?