

Global threats to cassava: Uncovering the pathogen complexes behind witches' broom and frogskin diseases

DSMZ



Sheat S. ¹, Oliveria S. A. S. De², Cuellar W. ³, Oliveira,

E.J. De², Newby J. ⁴, Winter S. ¹



samar.sheat@dsmz.de



@SamarSheat



Samar Sheat

¹Leibniz Institute DSMZ, German Collection of Microorganisms and Cell Cultures GmbH, Braunschweig, Germany

²Embrapa Mandioca e Fruticultura, Rua Embrapa, s/n, Centro, 44380000 Cruz das Almas, Brazil

³Virology and Crop Protection Group, Alliance of Bioversity International and CIAT, Columbia

⁴Cassava Program, Alliance of Bioversity International and CIAT, Lao PDR

Background

Why it matters?

- Cassava feeds over 800 million people worldwide.
- Emerging diseases with unclear causes are threatening harvest and seed systems.
- Two diseases of concern:
 - Witches' broom (Asia & Brazil)
 - Frogskin (South America).



CWBD Profile

- Shortened internodes
- Fungus oozing out of petioles
- Necrosis in stems and cortex of tubers

Where is the problem?



CFSD Profile:

- Thickened corky skin.
- symptoms appear at harvest
- chlorosis, vein clearing, stunting

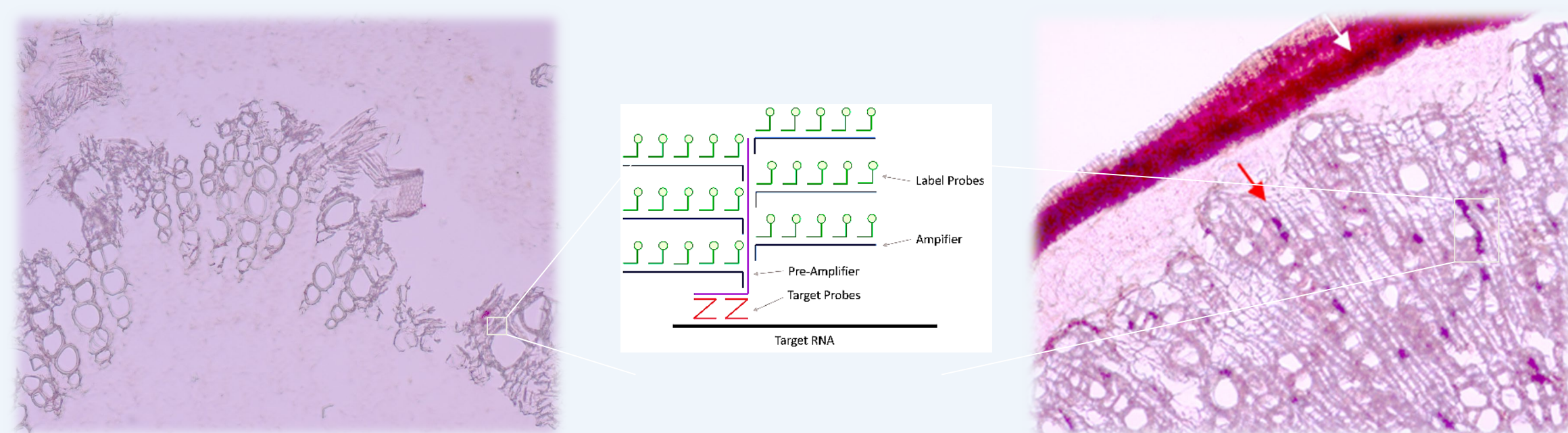


Objectives

- Identify pathogens associated with cassava witches' broom (CWBD) and cassava frogskin disease (CFSD).
 - Develop tools (RNAscope®, multi-pathogen pipeline) to localize and confirm causative agents.
 - Assess resistance/tolerance in cassava varieties.

Materials & Methods

High resolution detection using RNAscope® ISH



Cross section through cassava stem tissue

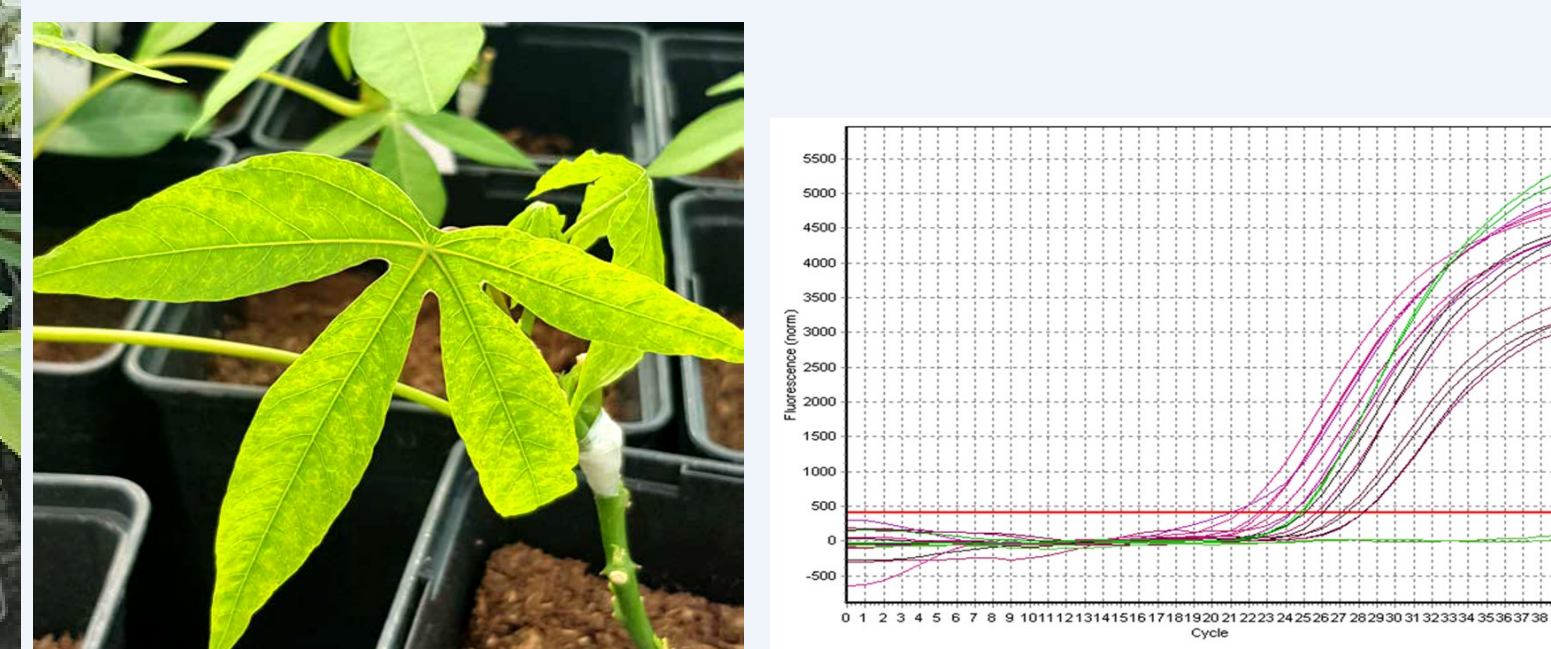
Red dots & red clusters indicate presence of pathogen

Pathogen Identification



Cassava infection by grafting with identified/ confirmed viruses and detection by qPCR

Resistance Testing



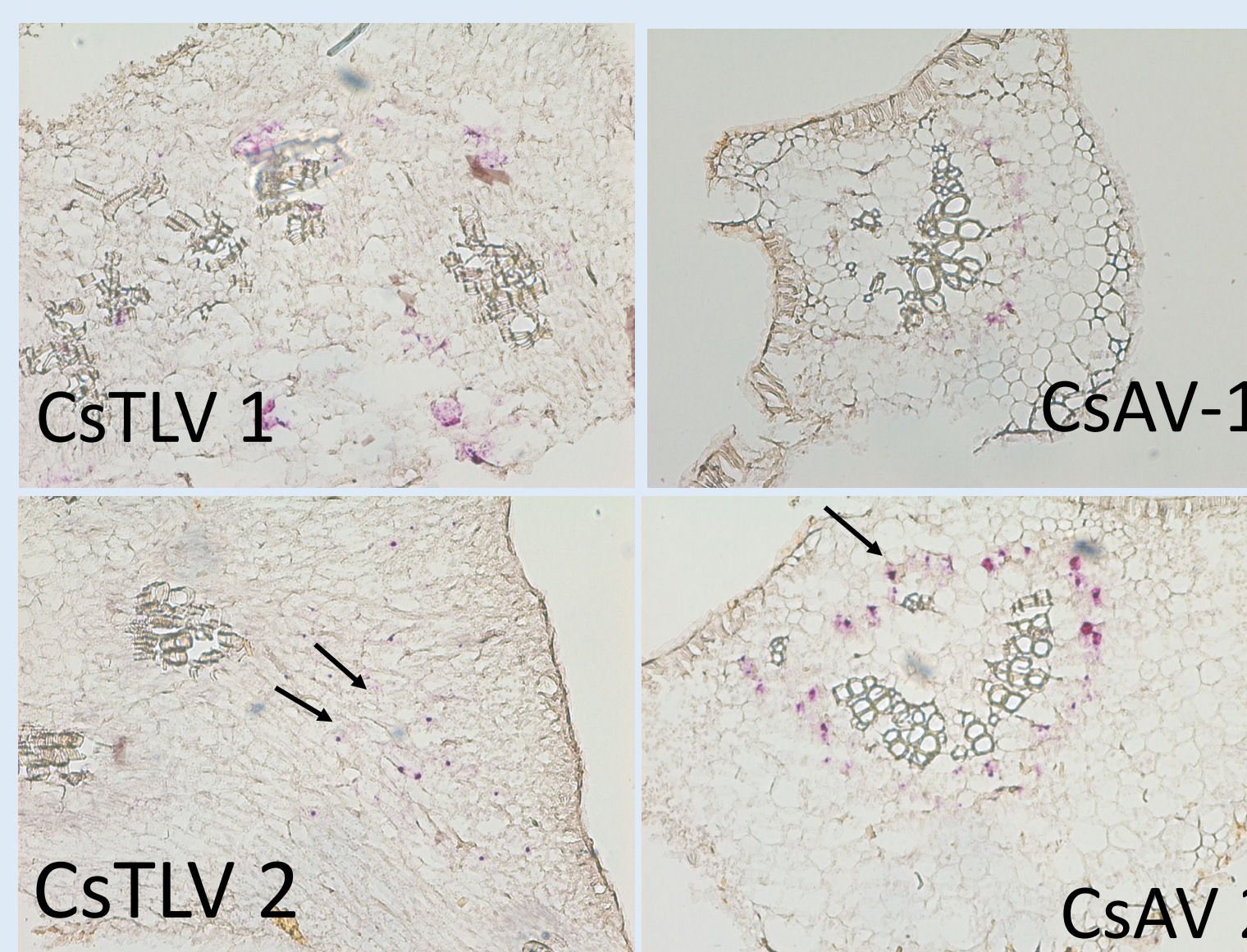
Results

CWBD is caused by the fungus *Ceratobasidium theobromae*



- Localizes to xylem tissues
- not evenly distributed in cassava
- Non-systemic infection causes problems in diagnosis
- Pathogen mostly present in symptomatic organs

CFSD is caused by several viruses with *Cassava torrado virus 2, CsTLV2* playing a major role



- CsAV1, CsAV2, and CsTLV2 are localized in phloem of leaves (red dots or red clusters);
- CsTLV1, has a broader distribution

African lines have resistance potential

- ✓ Severe symptoms on indicator Brazilian line



- ✓ African lines show only mild symptoms of CsTLV1 and much weaker symptoms in mixed infections CsTLV 1&2



Conclusions

- **CWBD** in Asia and Brasil is caused by the fungus *Ceratobasidium theobromae* confirmed by graft transmission and in situ localization in cassava tissues
- **CFSD** in South America is linked to a pathogen complex, with growing evidence for Cassava torrado-like virus 2 as a key causal agent.
- RNAscope® enabled precise localization of fungal and viral pathogens in host tissues.
- African cassava lines show resistance/tolerance to CFSD.

Implications and Next Steps

- **CWBD and CFSD threaten global cassava production and food security.**
- Pathogen-free planting material and regulated germplasm exchange are essential to maintain plant health.
- African resistant lines provide resources for breeding and pre-breeding
- Priorities: strengthen diagnostics, expand surveillance, and foster international collaboration to safeguard cassava.