Virus monitoring in grapevine genetic resources

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Motivation

Virus infections in viticulture have a negative impact on the physiology of the vines. They cause losses in grape quality and yield and consequently cause economic losses.
For the maintenance of genetic resources in *ex situ* collections virus infections are an increasing threat. As there are no effective curative methods to eliminate viruses in the vineyard, their spread currently can only be limited by monitoring the disease based on laboratory tests and by replacing infected vines by healthy plants.
Virus detection is mostly based on time consuming visual screenings in the field accompanied by ELISA (Enzyme-linked Immunosorbent Assay) or PCR (polymerase chain reaction) techniques, which are cost and time intensive. Non-invasive methods using sensors shall enable faster and a more cost-effective monitoring in the future.
At JKI Geilweilerhof genetic resources are organized in different thematic collections: e.g. table grapes, international *Vitis vinifera* cultivars, so called historical varieties and interspecific genotypes. All facing the increasing threat of virus infections and are therefore in need of improved management methods to be developed.

Aim

- Targeted virus screening based on a previous study (Bendel et al. 2020), to identify virus infected plants for future sensor analyses.
- Detection method implementation: reverse transcriptase reaction followed by multiplex-PCR
- Screen Materials: 1) four varieties (Aligote, Dolcetto, Riesling and Regent) of the international cultivars
  2) 17 varieties from the *Vitis vinifera* collection

150 grapevine plants and approx. 1000 PCR reactions

Table 1:Three RNA-viruses (Grapevine leaf roll associated virus- 1 and -3 (GLRaV-1 and GLRaV -3) and Grapevine Pinot Gris Virus (GPGV)) are of major importance in the investigation.

GLRaV-1	GLRaV-3	GPGV
Closteroviridae	*Closteroviridae*	*Betaflexiviridae*
Ampelovirus	*Ampelovirus*	*Trichovirus*
 Figure 1: Symptoms is premature autumn coloring in Pinot Blanc (Ipach, U. 2013)	 Figure 2: Symptoms in Pinot Noir (Ipach, U. 2013)	 Figure 3: GPGV symptoms on *Vitis Vinifera* (Bianchi et al. 2015)

Results

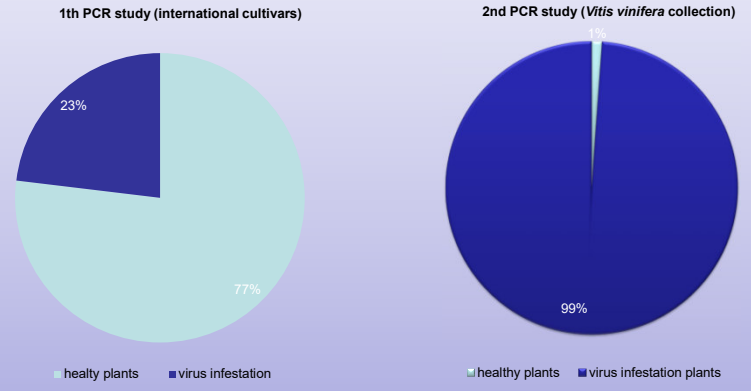

Figure 4: Study 1 showed a virus infection rate of 23% of the plants and study 2 revealed an infection rate of close to 100%.

Outlook

The 150 screened infected and non-infected plants are a very good training set for a sensor validation analyses. For that purpose spectral sensor data will be recorded and tested under laboratory conditions for correlation with data obtained by the reference method.

Non-invasive methods using sensors in the field shall enable faster and a more cost-effective monitoring in the future.

References
Bendel, Nele; Kicherer, Anna; Backhaus, Andreas; Köckerling, Janine; Maixner, Michael; Bleser, Elvira et al. (2020): Detection of Grapevine Leafroll-Associated Virus 1 and 3 in White and Red Grapevine Cultivars Using Hyperspectral Imaging. In: *Remote Sensing* 12 (10), S. 1693. DOI: 10.3390/rs12101693
Bianchi, G. L.; Amicis, F. de; Sabbata, L. de; Di Bernardo, N.; Governatori, G.; Nonino, F. et al. (2015): Occurrence of Grapevine Pinot gris virus in Friuli Venezia Giulia (Italy): field monitoring and virus quantification by real-time RT-PCR. In: EPPO Bull 45 (1), S. 22–32. DOI: 10.1111/epp.12196.
Ipach, U. (2013): Blattrollkrankheit. Abteilung Phytomedizin (Gruppe Weinbau), Dienstleistungszentrum Ländlicher Raum Rheinpfalz, Neustadt an der Weinstraße.

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