

Monitoring of Hop Stunt Viroid and of Dangerous Viruses in German Hop Gardens

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Introduction

Viroids, especially the Hop stunt viroid (HSVd), and viruses are important pathogens in hop production worldwide causing losses of yield and quality. They are spread efficiently by mechanical means during cultivation activities within a hop garden and from one garden to another. Viroids and viruses cannot be controlled by plant protection measures. The majority of viruses are transmitted by aphids; due to the non persistent way of transmission virus infections cannot be controlled by spraying of chemicals. For plant breeding no resistance genes are available. Thus, preventive measures like monitoring programs are of utmost importance. From 2008 to 2010 more than 650 hop samples were analyzed for HSVd but not for viruses. Only limited data were available concerning virus infections suggesting the occurrence of at least Hop mosaic virus (HpMV) and Apple mosaic virus (ApMV). To detect and eradicate primary sources of potential HSVd infections and to elucidate the virus situation in Germany's hop production a broad scale monitoring of important viruses and HSVd in German has been started in 2011. Our monitoring project funded by the "Wissenschaftliche Station für Brauerei in München e.V." reveals the current HSVd and virus situation and allows risk assessment.

Methods

Leaf samples were taken in all German hop growing regions; plants showing symptoms of abnormal growth were preferred. Samples sent to the virus laboratory of the Bav. State Research Center for Agriculture were analyzed for HpMV, ApMV and Arabis mosaic virus (ArMV) by ELISA and by RT-PCR for HSVd and Hop latent carlavirus (HpLV); part of the samples were tested for American hop latent carlavirus (AHpLV). RNA extraction was performed as described by Seigner et al. (2007). Primers and thermal cycling conditions were kindly provided by Dr. Ken Eastwell, WSU, Prosser, USA. An internal nad5 mRNA based RT-PCR control was included.

Results

- Since 2008 a total of 1,168 samples has been tested for HSVd. HSVd was only found in 9 samples in 2009 and could be eradicated effectively.
- Viruses are wide-spread (Fig. 1): only 17 % (2011) and 20 % of samples (2012) without virus infections
- Mixed infections are frequent: more than one virus in 30 % (2011) or 36 % (2012) (Fig. 2) of all samples
- Predominance of carlaviruses HpMV and HpLV (75-80 % of samples); less ApMV (app. 30 %), nearly no ArMV infections; ApHLV detected, but not fully evaluated due to the small sample number
- Infection frequency presumably overestimated due to predominately sampling of suspicious hops.

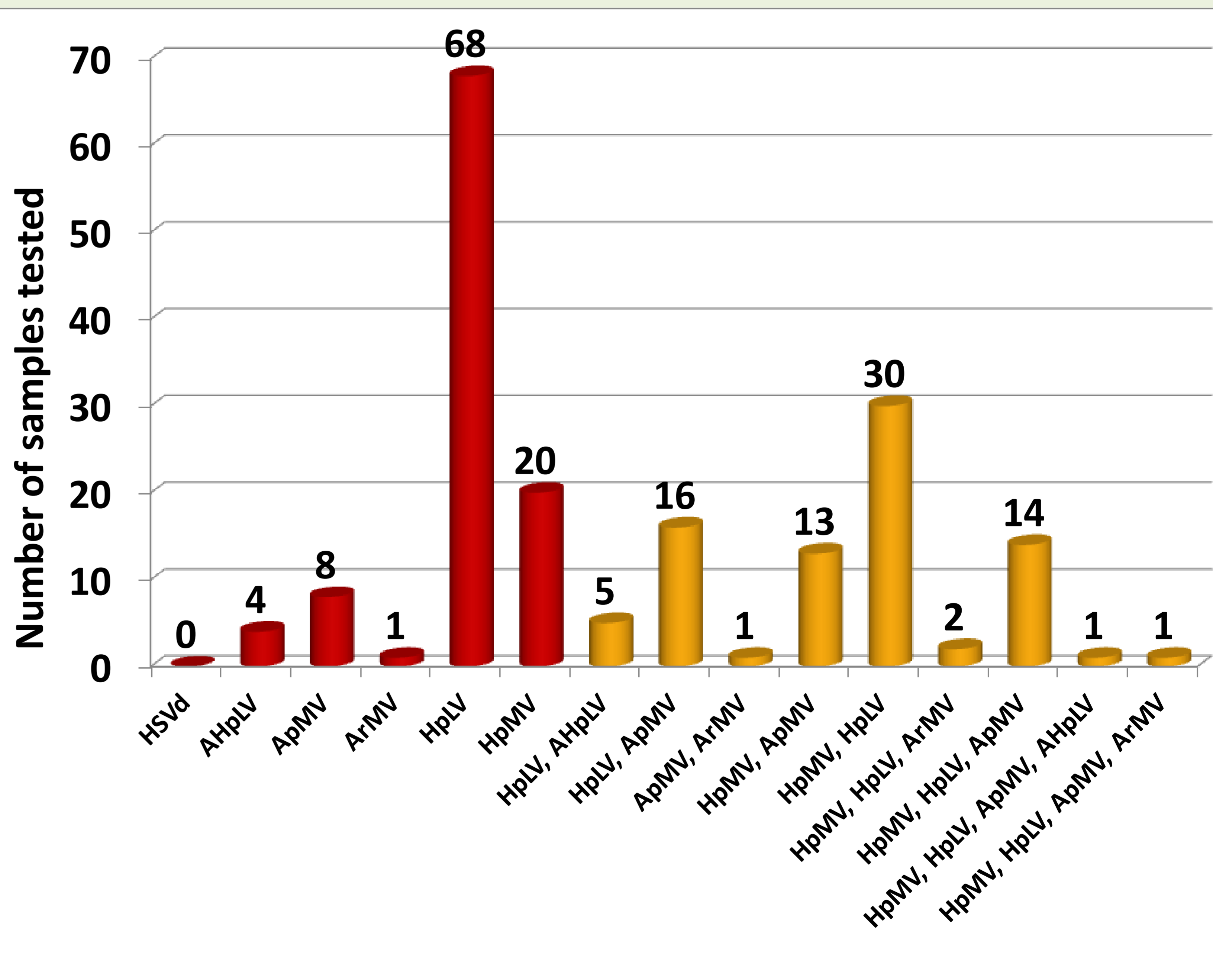
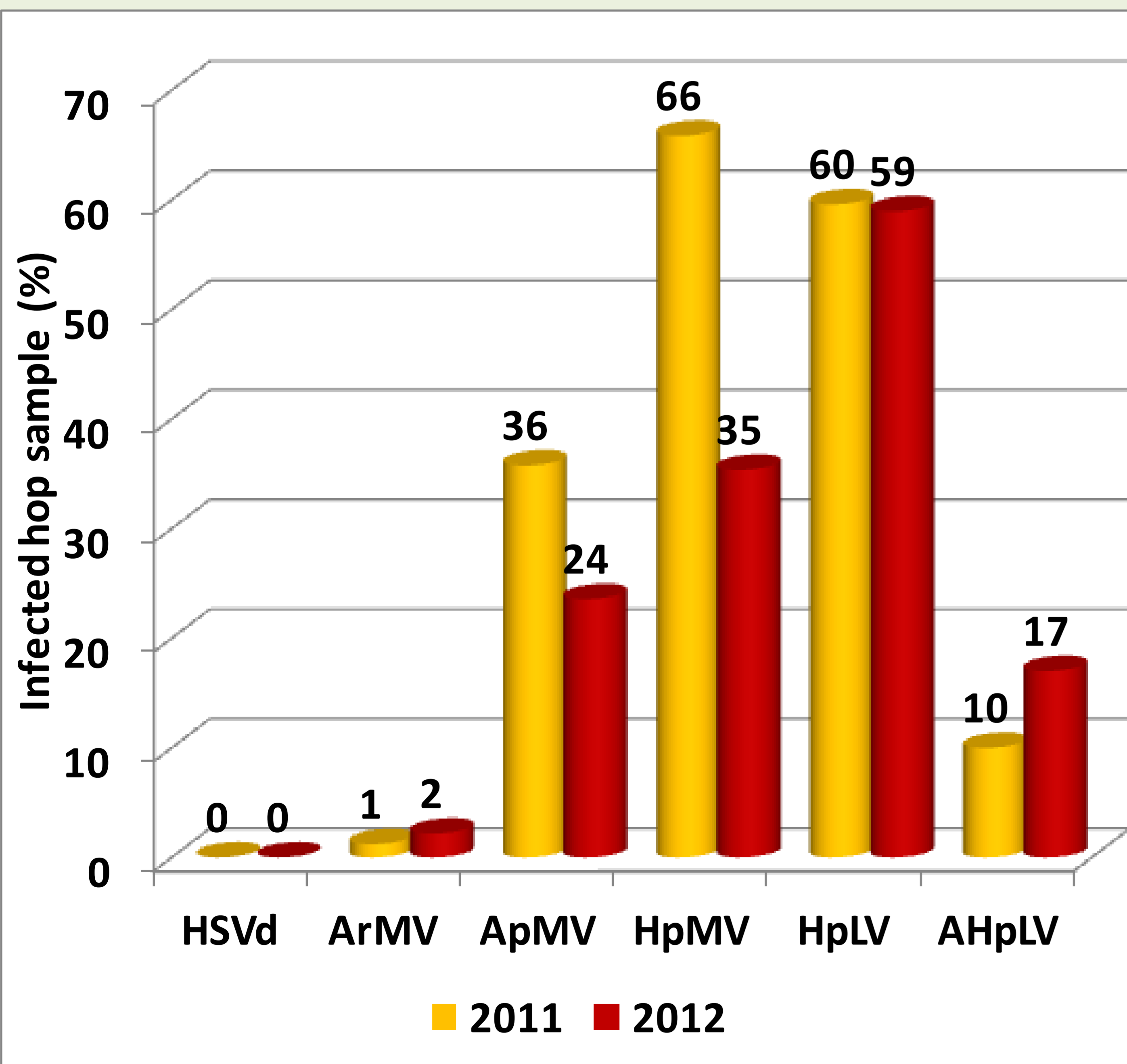


Fig. 1: Percentage of hop samples tested positive for different viruses in German hop gardens in 2011 and 2012. HSVd was not detected.

Fig. 2: Numbers of samples tested in 2012 with single or mixed virus infections; in 46 samples whether HSVd nor viruses were found (number of hops tested: HSVd: 220; HpMV, HpLV, ApMV, ArMV: 230; ApHLV: 53)

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