

# Assessment of ApMV and HMV presence in recovered Saazer

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## Introduction

Hop (*Humulus lupulus* L.) as a vegetatively propagated perennial crop is frequently attacked by pathogens Pethybridge et al., (2008). All the original Saazer plants were fully infested by viruses and viroids. Recovery process was therefore necessary to get virus-free planting material with higher biological value. Long-range observation of healthy status in hop gardens planted with recovered hop plants is an inseparable part of our recovery program.

## Material and Methods

Selected hop gardens in Žatec (Saaz) and Ústěck hop regions were planted by recovered hop planting material (Svoboda & Kopecký, 1996) in 1991-2009. Presence of viruses was assessed there in 1994-2012. Samples were regularly taken in May and June from the same plots. Such a plot included 80-96 plants. Hop samples were evaluated by a method of mass samples. Presence of ApMV and HMV were determined by ELISA (Svoboda & Malířová, 2006). Common agro-technical operations were carried out there.

## Results

In Czech Republic the main cultivated variety is Saazer. It is fine aroma semi-early red-bine hop (traditional), Osvald's clones 31, 72, 114. It is grown in the regions of Žatec (Saaz), Ústěck (Auscha) and Tršice (Trsitz) see Fig. 1. Total acreage is 4 339 ha. Saazer is grown on 3 804 ha (87,67 %), 535 ha (12,33 %) are new varieties (Table 1). Total acreage and yield of hop in period 2002-2012 are shown in Table 2. All Saazer Czech hops were fully infected by viruses (viroids) and content of alpha acids was slowly fallen down.

Within our research project we evaluated plants sampled from 22 hop gardens in Saaz region and 8 hop gardens in Ústěck region (Table 3). All these hop gardens were established as new ones, it means on the plots where hop was not grown before at all or after several years' pause. The only exception was a hop garden in Kněževě (493), which was started in 1997 without a pause between hop growing. No visual symptoms of virus affection were found out in all the tested plants. If the evaluation was carried out with the help of ELISA very low presence of ApMV and HMV was founding out for the whole time of assessment (Table 3). Nevertheless, higher infestation by these viruses was detected in the samples taken from the above-mentioned locality at Kněževě (493), which may have been caused by infected parts of hop plants, which remained there after the liquidation of the previous hop plants. This knowledge is very important for establishment of new hop gardens when we must realized how important it is to completely get rid of old crowns. Minimally 2-3 years' pause is recommended before we plant new rootstocks and start a new hop garden.

It was found that re-infection by ApMV and HMV in the conditions of common natural infection pressure and under routine agro-technical operations is very low and hop plants are able to keep a good health status for the whole lifetime. It is very important knowledge for hop growers, propagators and breeders.

## Acknowledgement

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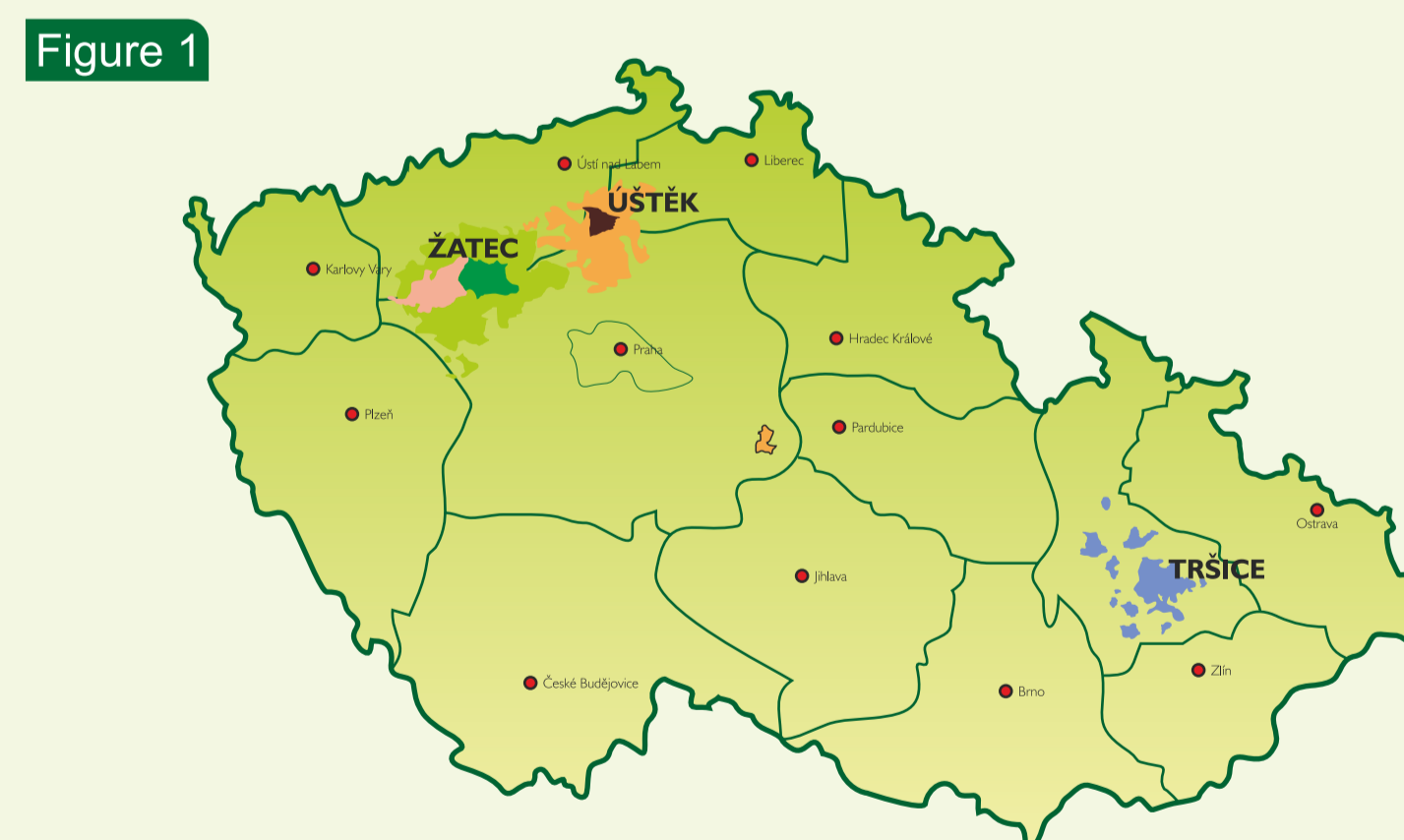
**Table 1**  
Acreage (ha) of hop varieties in Czech Republic (30.4.2013)

Variety	Region			Czech Republic
	Zatec (Saaz)	Ústěck (Auscha)	Tršicko (Trsitz)	
ZPC	3 016	391	397	3 804
Agnus	48	3	0	51
Bohemie	1	0	1	2
Bor	3	2	0	5
Perle	1	0	1	2
Hallertau Tradition	1	0	0	1
Harmonie	5	0	0	5
Kazbek	3	0	0	3
Premiant	118	44	40	202
Rubin	1	0	0	1
Saaz late	7	0	2	9
Saaz special	6	0	0	6
Sisdek	161	18	55	234
Vital	2	0	0	2
Others	13	0	0	13
<b>Total</b>	<b>3 386</b>	<b>458</b>	<b>495</b>	<b>4 339</b>

ZPC = Saaz semi-early red-bine hop

**Table 2**  
Acreage and yield of hop in Czech Republic in 2002 - 2012

Year	Acreage (ha)	Yield (t/ha)
2002	6 075	1,08
2003	5 968	0,93
2004	5 942	1,08
2005	5 838	1,38
2006	5 872	1,01
2007	5 414	1,04
2008	5 389	1,27
2009	5 335	1,25
2010	5 307	1,49
2011	4 832	1,31
2012	4 366	0,99



**Table 3**  
Evaluation of ApMV and HMV occurrence in hop gardens in 1994-2012

No. Hop garden	Year of planting	Variety	ApMV and HMV																		
			1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Zatecko (Saaz)</b>																					
1 Kystra 80	2001	Os.cl. 31																			
2 Pílepy 211	2002	Os. cl.31																			
3 Stekník, Zastávka	2004	Os. cl. 31																			
4 Stekník 149	1992	Os. cl. 72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 Pochválov 251	1993	Os. cl. 72																			
6 Holedeč 105	1993	Os. cl. 72	0											+	0	+	0	0	0	0	+
7 Stebno 90	1994	Os. cl. 72																			+
8 Očíhovec 239	1995	Os. cl. 72																			
9 Petrohrad 176	1996	Os. cl. 72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10 Petrohrad 178	1996	Os. cl. 72																			
11 Šlapanice 57	1996	Os. cl. 72																			
12 Lišany 114	1996	Os. cl. 72																			
13 Lhota 103	1997	Os. cl. 72																			
14 Kněževě 493	1997	Os. cl. 72																			
15 Stekník 171	1999	Os. cl. 72																			
16 Siřem 127	1999	Os. cl. 72																			
17 Staňkovic 171	1999	Os. cl. 72																			
18 Stekník, Zastávka	2004	Os. cl. 72																			
19 Černčice 175	1999	Os. cl. 114																			
20 Dívce 377	2002	Os. cl. 114																			
21 Stekník, Zastávka	2004	Os. Cl. 114																			
22 Ročov 402	2009	Os. cl. 114																			
<b>Ústěcko (Auscha)</b>																					
1 Lounky 90	2003	Os. cl. 31																			
2 Vědomice 38	1991	Os. cl. 72	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 Brozany 44	2000	Os. cl. 72																			
4 Ústěck 5	2003	Os. cl. 72																			
5 Siřejovice 19	2008	Os. cl. 72																			
6 Siřejovice 19	2010	Os. cl. 72																			
7 Polepy 117,V.F.H.	2007	Os. cl. 114																			
8 Polepy 117,CH.I.	2007	Os. cl. 114																			

