

# Wild Hops – New Sources for Resistance to Powdery Mildew

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## Introduction

Hop powdery mildew (*Podosphaera macularis* ssp. *humuli* Braun) can cause heavy infections on leaves and in particular on cones associated with drastic loss of yield and quality on susceptible hop varieties. In 2002, for example in the Hallertau hop growing region 4.9 million € had to be spent for pesticides to control this disease. Thus, the main focus at the Hop Research Center Hüll is to improve resistance to hop powdery mildew (PM) in Hüll breeding lines and new cultivars.

## Objective

Extensive studies on the virulence spectrum of powdery mildew populations from the Hallertau, England, France, and the USA had revealed that all hop resistance genes (*R1 – R6*, and *RB*) currently known were overcome by virulent strains of PM. Thus, for hop breeding it was urgently needed to look for new sources of resistance which were expected to be found in wild hops.



## Material and Methods

Young seedlings derived from seeds of wild hops collected from Germany, Austria, Belgium, China, Finland, Hungary, Italy, Japan, New Zealand, Norway, Russia, Slovakia, Sweden, Turkey, Ukraine, and the USA were tested in the greenhouse (mass selection and later on as single pot plants), laboratory and also in the fields for their reactions towards powdery mildew (PM).

In the greenhouse young seedlings were tested for their reaction to PM strains of the *v3*, *v4*, *v6*, *vB* virulence type which already occur in the Hallertau region. Subsequently, resistant individuals were retested in the laboratory using the detached leaf assay where PM isolates carrying the *v1*, *v2* and *v5* virulence genes were deployed. So far these PM pathotypes are not indigenous in Germany. Resistant wild hops were also grown in the fields under natural infection conditions. Tests with resistant plants were repeated at least four times per vegetation period over 2-5 years.



## Results

Since 2001 more than 15,000 wild hops from Europe, North America, Australia, and Asia have been screened in the greenhouse for PM resistance. Seedlings being assessed as resistant to PM pathotypes indigenous in Germany were retested in the laboratory deploying PM isolates which do not occur in the Hallertau region.

In this way wild hops were tested for their reaction to eight different monosporic isolates of *P. macularis* ssp. *humuli* encompassing the whole spectrum of virulence genes available so far (*v1-v6*, and *vB*) which allowed to identify new, so far unknown hop resistance genes which could not be overcome by the virulent PM strains currently available. Field tests were also conducted, but the assessment of resistance under natural infection conditions in the fields was limited due to low infection pressure in the years from 2003 onwards.

Hitherto, 56 very promising wild hops were identified showing resistance to all virulent PM strains currently known.



Wild Hops - Origin		No.	Sex
Germany	Bavaria, Baltic Sea, Berlin, East. Germany, Eifel, Saxony	14	female
		11	male
Turkey	Bursa	4	female/
		3	male
China/Japan	unknown	15	female/
		5	male
Sweden	Julita	1	female
New Zealand	unknown	1	female
USA	Nebraska	2*	female/
			male

\* promising wild hops - results based on testing for two years

## Perspectives

Resistant individuals with other valuable traits are used as crossing partners in our breeding programs to broaden the genetic basis for PM resistance in the Hüll hop germplasm. This is the basis for the development of top quality hop cultivars with an increased level of resistance to PM.

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