



# Resistance to powdery mildew in winter barley in Poland

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Winter barley is an important cereal crop and it is grown in all agricultural regions of Central and Western Poland.

The powdery mildew caused by *Blumeria graminis* f. sp. *hordei* is one of the most frequently observed disease on winter barley which can cause considerable yield losses.

The disease can be controlled with fungicides but their frequent use speeds up the evolution of fungicide resistance.

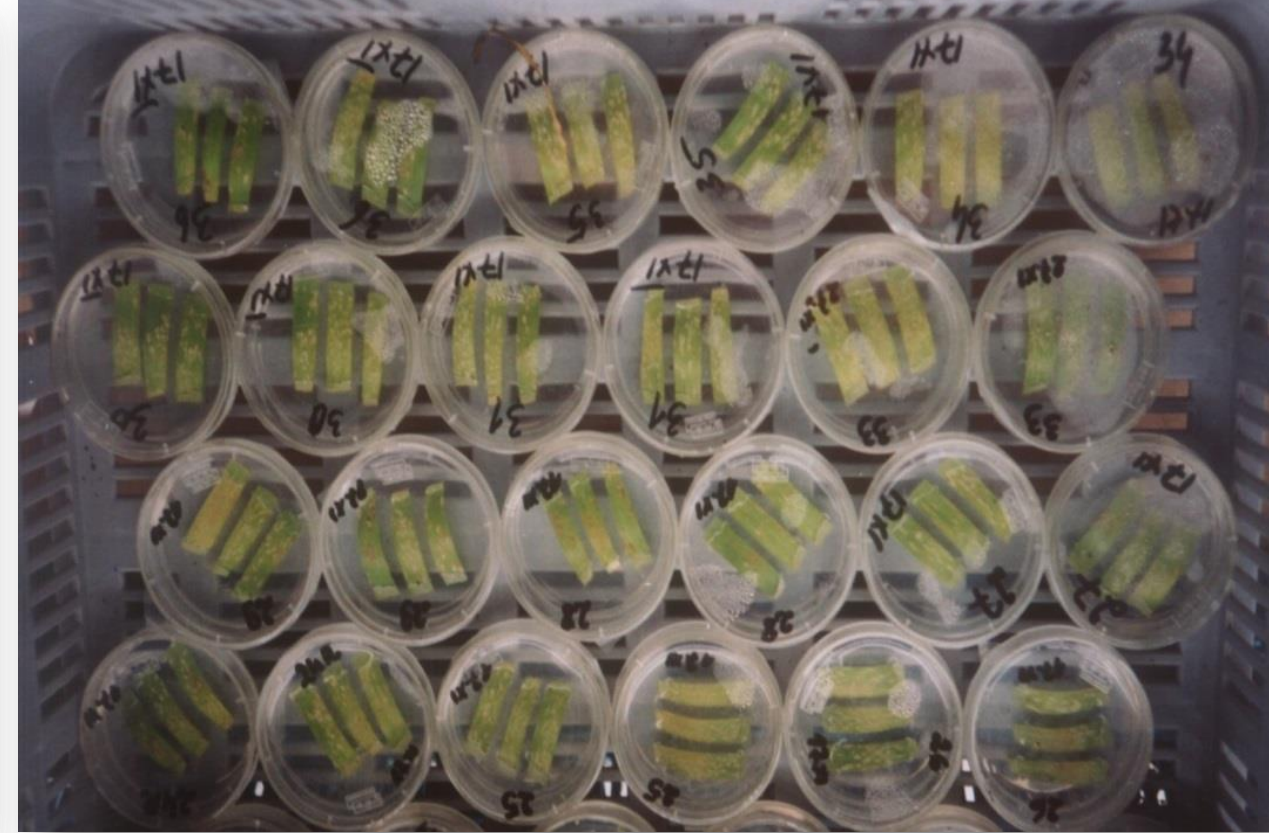
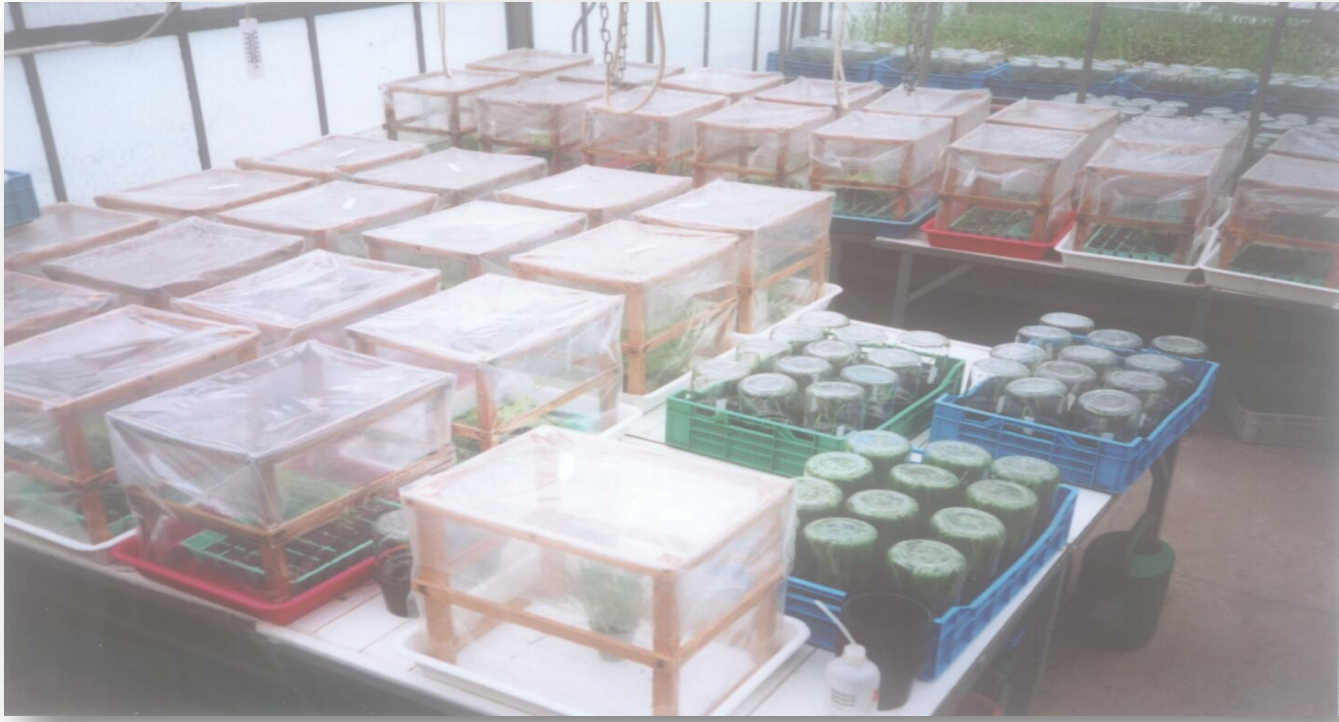
The use of resistant cultivars is effective method to control powdery mildew and the incorporation of new genes for resistance to powdery mildew into barley cultivars has been very useful in combating powdery mildew.

The resistance conferred by most of new resistance genes has not been maintained for more than a few years with some exceptions.

One of these exceptions is the Mlo resistance. Mlo resistance has become a very important source of powdery mildew resistance in barley because there is no known virulence for these genes.

Since 1979 (registration of cultivar 'Atem') the Mlo resistance has been deployed in more than 150 cultivars of spring barley in Europe.

However, none of barley winter cultivar with mlo resistance to powdery mildew is grown in Poland.



## Objective

The aim of presented investigation was to obtain information about agricultural value of F<sub>4</sub>BC<sub>1</sub> winter barley lines with the mlo gene for resistance to powdery mildew (*B. graminis* f.sp. *hordei*) under various agricultural conditions in Poland.

## Materials and Methods

Four cultivars (Souleyka, Titus, SU Vireni and Metaxa) as high yielding parents were used. These lines are characterized by high and stable yield potential under Polish conditions. In addition, existing resistance genes to powdery mildew in these cultivars were preserved.

Two lines (BKH 735 and line 42) as parents with mlo resistance were used. Line BKH 735 with resistance mlo was obtained in Laboratory of Applied Genetics IHAR-PIB Radzików in years 2002-2011. This line was selected from population obtained from crosses of cultivars Carola, Danuta and Bażant. Line 42 was obtained from crosses between cultivars Vanesa, Metaxa and Rasbet.

Combinations of barley crosses and backcrosses evaluated evaluated in the prent study.

6-row	2-row
(BKH 735 x Souleyka) x Souleyka	(linia 42 x SU Vireni) x SU Vireni
(BKH 735 x Titus) x Titus	(linia 42 x Metaxa) x Metaxa

Selection for presence of mlo gene was conducted in backcrosses populations was done using phenotyping method under field (natural infection) and greenhouse conditions (differential barley lines for resistance genes for powdery mildew and differential fungus isolates).

To confirm the presence of mlo gene in selected backcrosses lines MAS strategy was applied using molecular markers SSR: HVmlo1 and HVmlo3 .

Field trials with 200 F<sub>4</sub>BC<sub>1</sub> lines (50 for each combination) were conducted during 2015/16 in 3 locations: Central (Radzików) and Western Poland (Szelejewo, Wiatrowo). The parental lines were used as control. Characteristics for agricultural value of tested lines were obtained.

## Results

Tab. 1. Agricultural value of F<sub>4</sub>BC<sub>1</sub> barley lines with mlo resistance and their parents under Polish conditions (average for 50 lines in each combination, parents used as control).

Genotype	Plant vigor		Disease resistance				heading (number days from 1.01.)	height (cm)
	before winter	after winter	powdery mildew	barley rust	net blotch	yellow rust		
BKH 735	8,5	8,5	8,8	7,3	6,0	9,0	136,0	117,8
Souleyka	8,8	8,8	7,5	7,0	6,0	9,0	133,8	118,3
Titus	8,8	8,8	8,0	7,2	5,2	8,6	135,0	124,8
(BKH 735 x Souleyka) x Souleyka	8,8	8,8	8,3	6,4	6,1	8,9	133,9	123,7
(BKH735 x Titus) x Titus	8,8	8,8	8,6	7,3	5,8	8,6	134,4	122,3
L 42	8,4	8,4	9,0	6,1	6,1	8,0	139,4	117,8
SV Vereni	8,5	8,5	8,0	4,5	5,0	8,3	135,5	120,3
Metaxa	7,8	7,8	8,8	6,6	4,8	7,4	134,6	101,8
(L 42 x SV Vereni) x SV Vereni	8,8	8,8	8,7	5,3	5,1	8,4	134,3	113,6
(L42 x Metaxa) x Metaxa	8,3	8,3	9,0	6,3	5,7	8,2	137,6	114,3

## Conclusions

The practical outcome of presented investigation is to use of MAS in introduction of Mlo resistance into background of winter barley germplasm with valuable economical characteristics in Polish agricultural conditions.

Obtained lines can be used in barley breeding programs for powdery mildew resistance.

## Acknowledgements

This work was conducted in project: Interaction between powdery mildew (*Blumeria graminis* f.sp. *hordei*) resistance determined by mlo gene and economical value characteristics in winter barley. 2014-2020. Programme: Basic Research for Biological Progress in Crop Production; Funded by the Ministry of Agriculture and Rural Development Proj. No. 4-1-04-3-01 (27).

## Literature

1. Higgins, C.M., Hall, R.M., Campbell, P.R., Dietzgen, R.G. 2000. PCR rescue and analysis of transgene sequences directly from crude extracts of transgenic embryos and plants. Plant Molecular Biology Reporter 18: 285a-285g.  
2. Bilgic, H. Steffenson B.J., Hayes P.M. 2006. Molecular mapping of loci conferring resistance to different pathotypes of the spot blotch pathogen in barley. Phytopathology 96:699-708.  
3. <http://wheat.pw.usda.gov/cgi-bin/graingenes/report.cgi?class=marker&name=HVMLOH1A>

