

Wheat leaf rust (*Puccinia triticina* Eriks.) virulence frequency and detection of resistance genes in wheat cultivars registered in the Czech Republic in 2016–2018



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Material and Methods

- Samples of *Puccinia triticina* Eriks. (*Pt*) were collected on leaves of susceptible cultivars in Czech Republic during 2016 - 2018. Virulence of isolates was tested on Thatcher near-isogenic lines containing single individual *Lr* genes in controlled conditions of a greenhouse
- Furthermore, field resistance tests were carried on a selection of wheat cultivars registered in 2016 - 2018 using a mixture of *Pt* isolates. Symptoms were evaluated on a field scale 1 – 9 (1 – susceptible, 9 – resistant)



Molecular markers used to postulate the presence of resistance genes. PCR reaction parameters can be found in respective sources.

Gene	Chromosome location	Marker	Positive PCR product	Primer sequences	Reference
<i>Lr1</i>	5DL	WR003	760 bp	GGGACAGAGACCTTGGTGGGA GACGATGATGATTGCTGCTGG	Qiu et al. 2007
<i>Lr10</i>	1AS	FI2245 Lr10-6/r2	310 bp	GTGTAATGCATGCAGGTTCC AGGTGTGAGTGAGTTATGTT	Gulyaeva et al. 2009
<i>Lr19</i>	7DL	SCS265	512 bp	GGCGGATAAGCAGAGCAGAG GGCGGATAAGTGGGTTATGG	Gupta et al. 2006a
<i>Lr24</i>	3DL	SCS1302 ₆₀₉	607 bp	CGCAGGTTCCAAATACTTTTC CGCAGGTTCTACCTAATGCAA	Gupta et al. 2006b
<i>Lr28</i>	4AL	SCS421 ₅₇₀	570 bp	ACAAGGTAAGTCTCCAACCA AGTCGACCGAGATTTTAACC	Cherukuri et al. 2005
<i>Lr26</i>	1BS	SECA2 SECA3	412 bp	GTTTGCTGGGGAATTATTTG TCCTCATCTTTGCTCTCGCC	de Froidmont et al. 1998
<i>Lr37</i>	2AS	VENTRIUP LN2	259 bp	GGCTACTGACCAAGGCT TGCAGCTACAGCAGTATGTACACAAA	Helguera et al. 2003
<i>Lr34</i>	7DS	csLV34	150 bp	GTTGGTTAAGACTGGTGATGG TGCTTGTATTGCTGAATAGT	Lagudah et al. 2006

- Molecular analysis was undertaken with DNA from wheat cultivars isolated using a commercial kit (Qiagen, Germany). PCR assays were performed with markers associated with resistance genes *Lr1*, *Lr10*, *Lr19*, *Lr24*, *Lr26*, *Lr28*, *Lr34*, and *Lr37*
- PCR products were visualised on an agarose gel using electrophoresis

Results and conclusions

- Based on the greenhouse tests *Lr9* and *Lr19* were the most effective resistance genes in years 2016 - 2018
- Resistance conferred by *Lr11*, *Lr13*, *Lr15* and *Lr17* is completely overcome by tested isolates of *Pt*
- *Lr37*-*Yr17*-*Sr38* complex from *Aegilops ventricosa* is found in Czech cultivars with the highest frequency, *Lr1* and *Lr10* was detected in five and four cultivars, respectively
- Most cultivars possessed one resistance gene, five cultivars possessed a combination of two resistance genes. KWS Silverstone and WPB Calgary were positive for three of the tested markers
- Field trials indicate that in several cultivars the resistance is conferred by unknown genes. Further testing needs to be done to identify these loci

Wheat leaf rust resistance genes in 19 cultivars registered in 2016 - 2018 identified through specific DNA - based markers and average field resistance rating in 2017 and 2018 tests.

Cultivars	<i>Lr1</i>	<i>Lr10</i>	<i>Lr19</i>	<i>Lr24</i>	<i>Lr26</i>	<i>Lr28</i>	<i>Lr34</i>	<i>Lr37</i>	2017	2018
AF Jumiko	+								-	-
Atuan	+							+	-	4.5
Barracuda									9	-
Butterfly	+							+	-	5.5
Cecilius								+	9	9
Faunus								+	5.5	5
Futurum				+					9	9
Gaudio								+	6.5	5.5
Johnson					+				-	6
KWS Silverstone	+	+						+	6	4
LG Imposanto		+						+	6.5	7.5
Penelope								+	6.5	6.5
Proteus		+						+	6.5	9
RGT Cesario				+					8	8
RGT Sacramento								+	7	7
Rivero	+							+	6.5	6
Sheriff				+					9	9
Steffi								+	6	6
WPB Calgary		+				+		+	-	-

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