

**Effect on barley genotypes (*Hordeum vulgare* L.)**
**The interaction between the fungal pathogens under combined stress treatment at the plant interface**

 Stress 1: *Puccinia hordei*  
 Stress 2: *Erysiphe graminis*  
 Stage of plant: First seedling leaf

The table shows the effect of *P. hordei* on *E. graminis* and vice-versa on the number of rust pustules, rust pustule size, uredospores germination, number of mildew colony, mildew area and productivity in barley cultivars

<b>The development of <i>P. hordei</i> on seedling barley previously inoculated with <i>E. graminis</i></b>			
<b>Cultivar</b>	<b>Treatment</b>	<b>Response under combined stress (Type B parameter*)</b>	
		<b>Mean number rust pustules/leaf</b>	<b>Mean rust pustule size (mm<sup>2</sup>) on leaves</b>
Mid as	<i>E. graminis</i> +2hr. interval + <i>P. hordei</i> (Sequential stress)	246	0.09
	<i>P. hordei</i>	249	0.12
	<i>E. graminis</i> +1-day interval + <i>P. hordei</i> (Sequential stress)	39	0.07
	<i>P. hordei</i>	27	0.1
	<i>E. graminis</i> + 2-day interval + <i>P. hordei</i> (Sequential stress)	66	0.09
	<i>P. hordei</i>	51	0.11
	<i>E. graminis</i> + 4-day interval + <i>P. hordei</i> (Sequential stress)	64	0.05
	<i>P. hordei</i>	144	0.07
	<i>E. graminis</i> + 6-day interval + <i>P. hordei</i> (Sequential stress)	15	0.04
	<i>P. hordei</i>	106	0.09
Zep hyr	<i>E. graminis</i> +2hr. interval + <i>P. hordei</i> (Sequential stress)	201	0.09
	<i>P. hordei</i>	228	0.11
	<i>E. graminis</i> +1 day interval + <i>P. hordei</i> (Sequential stress)	94	0.1
	<i>P. hordei</i>	58	0.1
	<i>E. graminis</i> +2-day interval + <i>P. hordei</i> (Sequential stress)	58	0.08
	<i>P. hordei</i>	89	0.12
	<i>E. graminis</i> + 4-day interval + <i>P. hordei</i> (Sequential stress)	112	0.05
	<i>P. hordei</i>	138	0.08
	<i>E. graminis</i> + 6-day interval + <i>P. hordei</i> (Sequential stress)	0	0.06



## Stress Combination and their Interactions in Plants (SCIP) Database

Website link- <http://www.nipgr.ac.in/scipdb.php>

	<i>P. hordei</i>	94	0.07	
Julia	<i>E. graminis</i> +2hr. interval + <i>P. hordei</i> (Sequential stress)	247	0.11	
	<i>P. hordei</i>	220	0.09	
	<i>E. graminis</i> +1day interval + <i>P. hordei</i> (Sequential stress)	67	0.05	
	<i>P. hordei</i>	96	0.08	
	<i>E. graminis</i> + 2-day interval + <i>P. hordei</i> (Sequential stress)	58	0.05	
	<i>P. hordei</i>	145	0.13	
	<i>E. graminis</i> + 4-day interval + <i>P. hordei</i> (Sequential stress)	100	0.05	
	<i>P. hordei</i>	154	0.07	
	<i>E. graminis</i> + 6-day interval + <i>P. hordei</i> (Sequential stress)	3	0.03	
	<i>P. hordei</i>	85	0.07	
Mazurka	<i>E. graminis</i> +2hr. interval + <i>P. hordei</i> (Sequential stress)	162	0.08	
	<i>P. hordei</i>	253	0.11	
	<i>E. graminis</i> +1day interval + <i>P. hordei</i> (Sequential stress)	128	0.06	
	<i>P. hordei</i>	122	0.07	
	<i>E. graminis</i> + 2-day interval + <i>P. hordei</i> (Sequential stress)	52	0.07	
	<i>P. hordei</i>	81	0.08	
	<i>E. graminis</i> + 4-day interval + <i>P. hordei</i> (Sequential stress)	97	0.06	
	<i>P. hordei</i>	187	0.09	
	<i>E. graminis</i> + 6-day interval + <i>P. hordei</i> (Sequential stress)	25	0.06	
	<i>P. hordei</i>	85	0.08	
<b>Development of rust on the adaxial leaf surfaces of seedling barley pre-inoculated with <i>E. graminis</i></b>				
<b>Cultivar</b>	<b>Treatment</b>	<b>Mean germination uredospores (%)</b>	<b>Mean no. rust pustule/leaf</b>	<b>Mean area of rust pustules (mm<sup>2</sup>)</b>
Zephyr	<i>E. graminis</i> (on abaxial surface) incubated for 24 hr.+ <i>P. hordei</i> (on adaxial surface) (Sequential stress)	34.2	116.5	0.175
	<i>E. graminis</i> (on adaxial surface) incubated for 24 hr.+ <i>P. hordei</i> (on adaxial surface) (Sequential stress)	30.3	35.8	0.149
	<i>P. hordei</i> (on adaxial surface)	34.9	116	0.194
<b>Reduction of rust on leaves pre-inoculated with <i>E. graminis</i> 4 days earlier</b>				
<b>Cultivar</b>	<b>Treatment</b>	<b>Mean number rust pustules/leaf</b>		

Zep hyr	<i>E. graminis</i> + 4 days interval + <i>P. hordei</i> (Sequential stress)	13.4																	
	<i>P. hordei</i>	42.9																	
<b>Mean no. rust pustules per leaf on leaves of cultivar Mazurka seedling barley pre-inoculated with <i>E. graminis</i></b>																			
<b>Cultivar</b>	<b>Treatment</b>	<b>Mean no. rust pustules/leaf</b>																	
Mazurka	<i>E. graminis</i> + 2hr. interval + <i>P. hordei</i> (Sequential stress)	255																	
	<i>P. hordei</i>	183																	
	<i>E. graminis</i> + 1-day interval + <i>P. hordei</i> (Sequential stress)	70																	
	<i>P. hordei</i>	117																	
	<i>E. graminis</i> + 4-day interval + <i>P. hordei</i> (Sequential stress)	82																	
	<i>P. hordei</i>	155																	
	<i>E. graminis</i> + 6-day interval + <i>P. hordei</i> (Sequential stress)	48																	
	<i>P. hordei</i>	82																	
<b>Effect on mildew of pre-inoculating different parts of seedling barley leaves with <i>P. hordei</i></b>																			
<b>Cultivar</b>	<b>Treatment</b>	<b>Mean no. mildew colonies</b>																	
Zep hyr	<i>P. hordei</i> on basal third leaf + 4-day interval + <i>E. graminis</i> uniform inoculation (Sequential stress)	39.4																	
	<i>P. hordei</i> on central third leaf + 4-day interval + <i>E. graminis</i> uniform inoculation (Sequential stress)	74																	
	<i>P. hordei</i> on distal third leaf + 4-day interval + <i>E. graminis</i> uniform inoculation (Sequential stress)	71.1																	
	<i>E. graminis</i> uniform inoculation	83.2																	
<b>Effects on mildew development of pre-inoculating seedling barley leaf with a central band of <i>P. hordei</i></b>																			
<b>Cultivar</b>	<b>Treatment</b>	<b>Mean rust colony size (mm<sup>2</sup>)</b>	<b>Mean no. rust conidiophores/mm<sup>2</sup></b>																
		<b>Distance from center of leaf (cm)</b>																	
		2.5 (Base)	2	1.5	1	0	1	1.5	2	2.5 (Tip)	2.5 (Base)	2	1.5	1	0	1	1.5	2	2.5 (Tip)
Zep hyr	<i>Ph</i> + <i>Eg</i> (Sequential stress)	1.88	1.38	1.34	0.55	0.28	0.95	1.18	1.54	1.24	1443	1259	1037	671	306	861	714	939	945
<b>Further to check effects on mildew development of pre-inoculating seedling barley leaves with <i>P. hordei</i></b>																			



Cultivar	Treatment	Mean germination of mildew conidia (%)		Mean formation of mildew appressoria (%)		Mean establishment of mildew colonies (%)	Mean area of mildew colonies (mm <sup>2</sup> )	Mean number conidiophores (mm <sup>2</sup> )	Productivity of conidia
		Day 1	Day 3	Day 1	Day 3	Day 3			
Zephyr	<i>Ph</i> + <i>Eg</i> (Sequential stress)	20.2	16.2	72	69.7	54	1.59	512	3.3
	<i>E. graminis</i>	15.2	18.1	64	81.7	53.9	2.33	1071	5.7

(*Ph*- *Puccinia hordei*; *Eg*- *Erysiphe graminis*)

For raw data – Click here (.xlsx file)

Reference– Round PA, Wheeler BEJ (1978) Interactions of *Puccinia hordei* and *Erysiphe graminis* on seedling barley. Ann. appl. Biol. **89**:21-35

**Note:** Values are presented as it is from the source article without subjecting to the calculation.

‘\*’- For more information on parameters classification, please refer to ‘methodology’ tab

**Inference From the study:** Round and Wheeler, 1978 studied the interaction between *P. hordei* (causal agent of rust) and *E. graminis* (causal agent of mildew) on barley cultivars Midas, Zephyr, Julia and Mazurka grown to first seedling leaf. The pre-inoculation of *E. graminis* on leaves decreased the number of rust pustules in comparison with the single inoculation *P. hordei*. Similarly, the pre-inoculation of *P. hordei* on leaves reduced the size and number of mildew colonies in comparison with the single inoculation of *E. graminis*. **Therefore, these observations revealed the antagonistic interaction among both the pathogens.**