

**Effect on wheat cultivars (*Triticum aestivum* L.)**
**The interaction between the fungal pathogens under combined stress at plant interface**

 Stress 1: *Pyrenophora tritici-repentis*  
 Stress 2: *Puccinia tritici*  
 Stage of plant: Seedling

The table shows the competitive interaction between fungus *P. tritici-repentis* and *P. tritici* in wheat cultivars in relation to the germination, appressorium formation, germ tube formation, fungal re-isolation, incubation period and disease lesion formed by the pathogen

| <b>Spore production in the absence of competition</b>  |                   |   |   |   |
|--|-------------------|---|---|---|
| <b>Cultivar</b>  | <b>Leaf stage</b> | <b>Treatment</b>  | <b>Response under combined stress (Type B Parameter*)</b> |   |
|  |                   |   | <b>Conidia (x10<sup>2</sup>)/leaf</b>                     | <b>Urediniospores(x10<sup>2</sup>)/leaf</b> |
| 2145   | Young             | <i>P. tritici-repentis</i> (1×10 <sup>4</sup> conidia/mL)   | 13.10   | --  |
|  | Old               | <i>P. tritici-repentis</i> (1×10 <sup>4</sup> conidia/mL)   | 40.77   | --  |
| Jagger   | Young             | <i>P. tritici-repentis</i> (1×10 <sup>4</sup> conidia/mL)   | 3.20  | --  |
|  | Old               | <i>P. tritici-repentis</i> (1×10 <sup>4</sup> conidia/mL)   | 6.69  | --  |
| TAM 217  | Young             | <i>P. tritici-repentis</i> (1×10 <sup>4</sup> conidia/mL)   | 10.77   | --  |
|  | Old               | <i>P. tritici-repentis</i> (1×10 <sup>4</sup> conidia/mL)   | 31.74   | --  |
| 2145   | Young             | <i>P. tritici</i> (2 mg spores/mL)  | --  | 15.68                                       |
|  | Old               | <i>P. tritici</i> (2 mg spores/mL)  | --  | 4.27  |
| Jagger   | Young             | <i>P. tritici</i> (2 mg spores/mL)  | --  | 213.4                                       |
|  | Old               | <i>P. tritici</i> (2 mg spores/mL)  | --  | 171.1                                       |
| TAM 217  | Young             | <i>P. tritici</i> (2 mg spores/mL)  | --  | 306.8                                       |
|  | Old               | <i>P. tritici</i> (2 mg spores/mL)  | --  | 210.3                                       |
| <b>Competition between <i>P. tritici-repentis</i> and <i>P. tritici</i></b>  |                   |   |   |   |
| Proportion of urediniospore production by <i>P. tritici</i> when <i>P. tritici-repentis</i> was present as a competitor compared to when <i>P. tritici-repentis</i> was absent |                   |   |   |   |
| <b>Cultivar</b>  | <b>Leaf stage</b> | <b>Treatment</b>  | <b>Proportion of urediniospores production</b>            |   |
| 2145   | Young             | <i>P. tritici</i> (2 mg spores/mL) + <i>P. tritici-repentis</i> (1×10 <sup>4</sup> conidia/mL) (Simultaneous stress) on 28 days old plant | 0.31  |   |



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

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

|          |       |  |       |
|----------|-------|--|-------|
|          | Old   | <i>P. tritici</i> (2 mg spores/mL) + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Simultaneous stress) on 28 days old plant                 | 0.14  |
|          | Young | <i>P. tritici</i> (2 mg spores/mL) + 3 days interval + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Sequential stress) on 28 days old plant | 0.35  |
|          | Old   | <i>P. tritici</i> (2 mg spores/mL) + 3 days interval + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Sequential stress) on 28 days old plant | 0.32  |
|          | Young | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + <i>P. tritici</i> (2 mg spores/mL) (Sequential stress) on 31 days old plant                   | 0.19  |
|          | Old   | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + <i>P. tritici</i> (2 mg spores/mL) (Sequential stress) on 31 days old plant                   | 0.38  |
| Jagger   | Young | <i>P. tritici</i> (2 mg spores/mL) + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Simultaneous stress) on 28 days old plant                 | 0.73  |
|          | Old   | <i>P. tritici</i> (2 mg spores/mL) + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Simultaneous stress) on 28 days old plant                 | 0.31  |
|          | Young | <i>P. tritici</i> (2 mg spores/mL) + 3 days interval + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Sequential stress) on 28 days old plant | 0.89  |
|          | Old   | <i>P. tritici</i> (2 mg spores/mL) + 3 days interval + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Sequential stress) on 28 days old plant | 0.58  |
|          | Young | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + <i>P. tritici</i> (2 mg spores/mL) (Sequential stress) on 31 days old plant                   | 0.54  |
|          | Old   | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + <i>P. tritici</i> (2 mg spores/mL) (Sequential stress) on 31 days old plant                   | 0.62  |
| TAM 2107 | Young | <i>P. tritici</i> (2 mg spores/mL) + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Simultaneous stress) on 28 days old plant                 | 0.25  |
|          | Old   | <i>P. tritici</i> (2 mg spores/mL) + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Simultaneous stress) on 28 days old plant                 | 0.086 |
|          | Young | <i>P. tritici</i> (2 mg spores/mL) + 3 days interval + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Sequential stress) on 28 days old plant | 0.40  |
|          | Old   | <i>P. tritici</i> (2 mg spores/mL) + 3 days interval + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Sequential stress) on 28 days old plant | 0.26  |



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|  | Young      | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + <i>P. tritici</i> (2 mg spores/mL) (Sequential stress) on 31 days old plant                   | 0.28                              |
|--|------------|--|-----------------------------------|
|  | Old        | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + <i>P. tritici</i> (2 mg spores/mL) (Sequential stress) on 31 days old plant                   | 0.16                              |
| Proportion of conidial production by <i>P. tritici-repentis</i> when <i>P. tritici</i> was present as a competitor compared to when <i>P. tritici</i> was absent |            |  |                                   |
| Cultivar   | Leaf stage | Treatment  | Proportion of conidial production |
| 2145   | Young      | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + <i>P. tritici</i> (2 mg spores/mL) (Simultaneous stress) on 31 days old plant                 | 1.11                              |
|  | Old        | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + <i>P. tritici</i> (2 mg spores/mL) (Simultaneous stress) on 31 days old plant                 | 1.10                              |
|  | Young      | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + 3 days interval + <i>P. tritici</i> (2 mg spores/mL) (Sequential stress) on 28 days old plant | 1.42                              |
|  | Old        | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + 3 days interval + <i>P. tritici</i> (2 mg spores/mL) (Sequential stress) on 28 days old plant | 1.20                              |
|  | Young      | <i>P. tritici</i> (2 mg spores/mL) + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Sequential stress) on 31 days old plant                   | 0.89                              |
|  | Old        | <i>P. tritici</i> (2 mg spores/mL) + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Sequential stress) on 31 days old plant                   | 0.96                              |
| Jagger   | Young      | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + <i>P. tritici</i> (2 mg spores/mL) (Simultaneous stress) on 31 days old plant                 | 0.58                              |
|  | Old        | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + <i>P. tritici</i> (2 mg spores/mL) (Simultaneous stress) on 31 days old plant                 | 0.66                              |
|  | Young      | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + 3 days interval + <i>P. tritici</i> (2 mg spores/mL) (Sequential stress) on 28 days old plant | 1.66                              |
|  | Old        | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + 3 days interval + <i>P. tritici</i> (2 mg spores/mL) (Sequential stress) on 28 days old plant | 1.37                              |
|  | Young      | <i>P. tritici</i> (2 mg spores/mL) + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Sequential stress) on 31 days old plant                   | 0.13                              |
|  | Old        | <i>P. tritici</i> (2 mg spores/mL) + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Sequential stress) on 31 days old plant                   | 0.21                              |



|             |           |  |       |
|-------------|-----------|--|-------|
| TAM<br>2107 | Youn<br>g | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + <i>P. tritici</i> (2 mg spores/mL) (Simultaneous stress) on 31 days old plant                 | 0.062 |
|             | Old       | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + <i>P. tritici</i> (2 mg spores/mL) (Simultaneous stress) on 31 days old plant                 | 0.87  |
|             | Youn<br>g | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + 3 days interval + <i>P. tritici</i> (2 mg spores/mL) (Sequential stress) on 28 days old plant | 0.86  |
|             | Old       | <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) + 3 days interval + <i>P. tritici</i> (2 mg spores/mL) (Sequential stress) on 28 days old plant | 1.18  |
|             | Youn<br>g | <i>P. tritici</i> (2 mg spores/mL) + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Sequential stress) on 31 days old plant                   | 0.58  |
|             | Old       | <i>P. tritici</i> (2 mg spores/mL) + <i>P. tritici-repentis</i> ( $1 \times 10^4$ conidia/mL) (Sequential stress) on 31 days old plant                   | 0.66  |

For raw data – Click here (.xlsx file)

Reference– AL Naimi FA, Garrette KA, Bockus WW (2005) Competition, facilitation, and niche differentiation

in two foliar pathogens. *Oecologia* **143**: 449-457

**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

**The inference from the study:** Al-Naimi *et al.*, 2005 studied the interaction between the facultative saprophyte *P. tritici-repentis* and obligate biotroph *P. tritici* in old and young leaves of the three wheat cultivars. Both the pathogens were inoculated singly and in combination in different orders on wheat leaves. Three winter wheat genotypes; 2145 supporting high reproduction in *P. tritici-repentis* only, Jagger supporting high reproduction in *P. tritici* only, and TAM 107 supporting high reproduction in both the pathogens. The overall data revealed that the competition among both the pathogens resulted in the high sporulation index for *P. tritici-repentis* than for *P. tritici* for all the cultivars. **The overall observations lead to the conclusion that due to interspecific competition *P. tritici* sporulation was substantially reduced in the presence of *P. tritici-repentis*, whereas *P. tritici-repentis* had proportionally low reductions in sporulation in the presence of *P. tritici* irrespective of the genotype supporting the high sporulation of either fungi.**