

Impact of Flag Smut Inoculum on Wheat Seedling Vigour

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Flag smut, caused by *Urocystis agropyri* (Preuss) Schroet, is a widely distributed disease in many wheat (*Triticum aestivum* L. em. Thell.) growing parts of the country and is of major importance in some areas of Haryana. Flag smut leads to considerable reduction in grain yield due to complete loss of productivity in infected plants. Seed quality is also greatly influenced by flag smut as the disease reduce, seed size, number of grains and 1000-seed weight [1]. Very little information is available in literature regarding the inoculum load on seed and seedling vigour. Therefore, the present study envisages the effect of inoculum load of flag smut on seed and seedling vigour in wheat.

Seeds of twenty one varieties of wheat (both resistant and susceptible), used in the present investigation, were smeared with two level of inoculum 10 and 20 g (inoculum powder kg^{-1} of seed, in flasks until the total inoculum powder adhered to the seed surface). 400 seeds from each treatment taken out randomly and used for germination test following ISTA rules [2]. All the twenty one varieties were tested for speed of germination. The inoculum was applied to the seed @ 20 g kg^{-1} seed. Seedling emergence was recorded starting from 4th day, daily, until the final count (i.e., 8th day). The index of speed of germination was calculated as described by Maguire [3]. Five seedlings from each replication were randomly chosen and their root and shoot length were measured.

The per cent seed germination was not significantly affected by both levels of inoculum in resistant varieties. It was above 85 per cent in all

varieties, whereas, in case of highly susceptible varieties (WH-147 and C-306) the germination percentage decreased significantly (Table 1). The per cent germination was 71.00 and 65.00, respectively at 10 g and 20 g inoculum level in variety WH-147. The results clearly indicated that inoculum level had no adverse effect on germination in resistant varieties, whereas, it affected significantly in susceptible and highly susceptible varieties. Similar observation was recorded in wheat when inoculated with Karnal bunt [5, 6]. These results are in confirmity with those of Rattiuasababady et al. [7], where 10 per cent reduction in seed germination was reported on inoculation with 10 per cent inoculum of *Macrophomina phaseolina* in blackgram.

Speed of germination was maximum in resistant varieties as compared to susceptible and highly susceptible varieties (Table 1). It ranged between 17.31 to 18.61 in resistant control seeds as compared to 16.90 to 18.53 in inoculated resistant cultivars, whereas, in susceptible cultivars it ranged between 13.65 to 14.89. Highest percentage decrease in speed of germination was recorded in PBW 343 (13.11%) followed by C-306 (11.01%) and WH-147 (10.15%). The decrease in speed of germination was below one per cent in resistant cultivars namely, UP 2425, WH-291, HD 2329 and WH-283. Similarly, speed of germination that is 18.55 and 18.05 was maximum in WH-291 and WH-896, respectively, whereas, it was minimum (13.72) in highly susceptible variety WH-147. The minimum per cent decrease in speed of germination (0.11%) was recorded in highly resistant variety UP 2425, whereas, highest

Table 1. Per cent seed germination, speed of germination, root and shoot length of different wheat varieties inoculated with flag smut inoculum

| Variety | Germination (%) | | | Speed of germination | | Decrease in speed of germ. (%) | Root length (cm) | | | Shoot length (cm) | | |
|---------------------------|-----------------|-----------|-----------|----------------------|-----------|--------------------------------|---------------------------|-----------|-----------|-------------------------|-----------|-----------|
| | Control | @ 10 g/kg | @ 20 g/kg | Control | @ 20 g/kg | | Control | @ 10 g/kg | @ 20 g/kg | Control | @ 10 g/kg | @ 20 g/kg |
| UP 2425 | 96.50 | 96.50 | 96.00 | 17.69 | 17.67 | 0.11 | 11.00 | 10.75 | 10.75 | 10.00 | 10.00 | 9.75 |
| WH 291 | 94.29 | 94.00 | 93.50 | 18.61 | 18.55 | 0.33 | 12.00 | 12.00 | 12.00 | 11.00 | 10.75 | 10.75 |
| HD 2329 | 94.25 | 93.75 | 93.00 | 17.90 | 17.86 | 0.22 | 10.50 | 10.50 | 10.25 | 9.00 | 9.00 | 8.75 |
| WH 896 | 97.00 | 96.50 | 96.25 | 18.20 | 18.05 | 0.84 | 12.75 | 12.50 | 12.50 | 10.75 | 10.50 | 10.50 |
| WH 283 | 97.00 | 97.00 | 97.00 | 17.99 | 17.98 | 0.05 | 11.00 | 11.00 | 11.00 | 10.25 | 10.25 | 10.00 |
| Sonalika | 91.00 | 88.50 | 87.50 | 17.31 | 16.90 | 2.36 | 10.75 | 10.00 | 9.75 | 9.75 | 9.00 | 8.75 |
| WH 533 | 85.50 | 80.00 | 78.50 | 16.52 | 15.44 | 6.53 | 8.50 | 7.75 | 7.25 | 7.50 | 7.00 | 6.00 |
| WH 157 | 89.25 | 88.29 | 87.50 | 17.23 | 16.56 | 4.29 | 10.00 | 9.25 | 9.00 | 9.00 | 8.25 | 8.00 |
| PBW 435 | 90.50 | 87.00 | 85.50 | 17.53 | 16.01 | 8.67 | 10.25 | 8.75 | 8.50 | 8.25 | 7.25 | 7.00 |
| Raj 3765 | 92.50 | 88.75 | 85.00 | 16.88 | 15.52 | 8.05 | 10.00 | 9.00 | 9.00 | 9.00 | 8.00 | 8.00 |
| HD 2687 | 88.75 | 83.75 | 81.00 | 16.82 | 15.54 | 7.60 | 10.00 | 9.00 | 8.75 | 8.50 | 7.50 | 7.25 |
| WH 542 | 88.00 | 81.00 | 80.50 | 16.54 | 15.41 | 8.70 | 8.00 | 7.25 | 7.00 | 6.50 | 5.25 | 5.25 |
| UP 2338 | 85.75 | 79.50 | 77.50 | 17.01 | 15.36 | 9.70 | 9.50 | 8.25 | 8.50 | 8.25 | 7.25 | 7.50 |
| Raj 3777 | 92.50 | 86.50 | 84.50 | 16.93 | 15.50 | 8.44 | 10.50 | 9.00 | 8.75 | 8.50 | 7.50 | 7.00 |
| PBW 373 | 86.75 | 82.50 | 80.50 | 17.11 | 15.93 | 6.89 | 9.00 | 8.25 | 8.50 | 7.50 | 6.25 | 6.25 |
| WH 416 | 92.50 | 86.50 | 85.00 | 16.61 | 15.03 | 9.51 | 8.00 | 7.00 | 6.75 | 6.50 | 5.25 | 5.00 |
| HD 2009 | 87.75 | 83.00 | 80.50 | 15.89 | 14.89 | 6.29 | 9.25 | 8.00 | 8.00 | 7.25 | 6.00 | 6.00 |
| PBW 343 | 88.50 | 80.25 | 77.50 | 15.71 | 13.65 | 13.11 | 9.50 | 8.00 | 7.75 | 10.00 | 8.25 | 8.00 |
| C306 | 87.75 | 80.00 | 79.50 | 15.79 | 14.05 | 11.01 | 12.00 | 10.25 | 10.00 | 10.00 | 8.25 | 8.00 |
| HD 2285 | 90.50 | 80.00 | 78.50 | 16.17 | 14.62 | 9.58 | 10.50 | 8.50 | 8.25 | 9.00 | 7.50 | 7.00 |
| WH 147 | 86.50 | 71.00 | 65.00 | 15.27 | 13.72 | 10.15 | 9.25 | 7.00 | 7.00 | 9.25 | 7.50 | 7.25 |
| C.D. (P=0.05) | | | | 0.53 | 0.64 | | | | | | | |
| Inoculum = 1.42 | | | | | | | Inoculum = 0.28 | | | Inoculum = 0.23 | | |
| Variety = 3.78 | | | | | | | Variety = 0.74 | | | Variety = 0.60 | | |
| Inoculum x Variety = 6.54 | | | | | | | Inoculum x Variety = 1.28 | | | Inoculum x Variety = NS | | |

decrease in speed of germination noticed in PBW-343 (13.11%) followed by C-306 (11.01%) and WH-147 (10.15%), the susceptible and highly susceptible varieties (Table 1).

The root length of resistant varieties namely, UP 2425, WH 291, HD 2329, WH 896 and WH

283 was not affected significantly by any level of inoculum (Table 1). It was 11.0, 10.75 and 10.75 cm in UP 2425 at 0, 10 and 20 g inoculum level, respectively and more or less same results were obtained in other resistant varieties. Whereas, in highly susceptible varieties HD 2285 and WH 147

the root length decreased significantly. The root length was 8.50 cm and 8.25 cm at 10 and 20 g inoculum level, respectively in HD 2285 as compared to 10.50 in control. More or less same results were obtained in WH-147.

The shoot length was 11.00 and 10.75 cm in variety WH 291 at 10 and 20 g inoculum level, respectively as compared to 11.00 cm in control. Therefore, results indicated that there was no effect of inoculum on shoot length in resistant varieties. More or less same results were obtained with other resistant varieties UP 2425, HD 2329, WH 896 and WH 283. In susceptible varieties (WH 147, C 306, PBW 343 and HD 2285) the shoot length decreased significantly (Table 1). In PBW 343 the shoot length at 10 g and 20 g inoculum was 7.00 and 6.75 cm as compared to 8.75 cm in control.

The results showed that seed lots with high initial inoculum level in susceptible varieties can significantly induce the field emergence and crop stand in wheat as these factors are dependent on germination per cent and seedling vigour.

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