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# Effect of Loose Smut Pathogen on Plant Growth and Seed Quality Parameters of Wheat

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**ABSTRACT** The investigation were carried out to evaluate the effect of loose smut pathogen on growth attribute and seed quality parameter in five cultivars namely Sonalika, PBW 65, PBW 343,VL-421 and HD 2687. The total number of tillers in infected plant were less as compared to healthy plants in all the cultivars, though the differences were significant only in susceptible cultivars i.e. Sonalika, HD 2687 and PBW 343. Length of peduncle in case of smutted plants was significantly reduced as compared to healthy plants, though the differences were more apparent in susceptible cultivars. Infection by *Ustilago segetum* var. *tritici* in seed results in reduction of 1000-grain weight and germination as compared to healthy seeds in all cultivars, but reduction was more apparent in susceptible cultivars.

**Key Words**: Loose smut, wheat, quality parameters

Loose smut caused by *Ustilago segetum* var. *tritici* occurs in all parts of the country wherever wheat is grown, but the incidence is high in humid areas. *Ustilago segetum* var. *tritici* causes infection through the stigma and the pathogen gets established deep into the developing seed and survives as dormant mycelium in the embryo. Thus it becomes a truly seedborne and seed transmitted disease. The crop raised from such infected seed gives rise to smutted spikes. Smut produces various kinds of vegetative modification in host plant [1]. Therefore, present investigation were undertaken to find out the effect of loose smut pathogen on tillering, length of peduncle and other seed quality parameters like 1000-grain weight and germination.

## MATERIALS AND METHODS

Effect of loose smut pathogen on wheat seeds were evaluated on the basis of two seed quality parameters (1000-grain weight and germination per cent) and two plant growth characters (tillers/plant and peduncle length).

During 1999-2000 sufficient number of ear-heads of five cultivars *viz.* Sonalika, PBW-65, PBW-343, HD-2687 and VL-421 were artificially inoculated with the chlamydospores of *U. segetum* var *tricici* using a continuous pipetting hypodermic syringe. The awns of the ear-heads were removed with the help of a pair of scissors and then inoculating each flower with known quantity of inoculum and then the ear-heads were covered with a butter paper bag. The inoculations were done in the afternoon at 4pm. At crop maturity, the inoculated ear-heads were harvested separately and the seeds were tested for embryo infection in the laboratory by whole embryo count method as suggested by Popp [2], with slight modifications. The infected seeds were stored properly for next year sowing.

Observations for 1000-grain weight (g) were taken both for healthy and inoculated seeds harvested from the five cultivars taken for the study. Further, per cent germination was determined by roll towel method for both healthy and inoculated seeds of all five cultivars.

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These experiments were replicated three times. The inoculated seeds were mixed with healthy seeds for sowing during next cropping season in the year 2000-01. At flowering stage observations were taken for peduncle length (cm) and tillers/plant in both healthy and infected plants for all the cultivars.

The above experiment for seed quality characters and plant growth characters were repeated for two consecutive years.

## RESULTS AND DISCUSSION

In case of 1000-seed weight it was observed that the susceptible cultivars showed more reduction when compared to tolerant cultivars. The percentage reduction in 1000-seed weight for susceptible cultivar Sonalika was found to be (12.2 and 11.34%) followed by PBW-343 (10.89 and 10.20 %), HD-2687 (6.82 and 8.09%), VL-421 (6.04 and 5.77%) and PBW-65 (5.04 and 4.05%) respectively in years 2000-01 and 2001-02 (Table 1). Similar trend was observed in the germination percentage in healthy and inoculated seeds in both susceptible and resistant cultivars. The percentage reduction in germination for susceptible cv. Sonalika (15.19 and 12.37%) was found to be maximum while the minimum percentage reduction in germination was observed in resistant cv.PBW-65 (4.33 and 4.26%), respectively in the year 2000-01 and 2001-02 (Table 1). Reduction in germination of inoculated seed was observed by Singh and Chand [3]. The reduction in 1000-seed weight may be attributed to the reduction in size of seed in inoculated plants. The present study also revealed that 1000-grain weight (g) and germination percentage were substantially reduced in infected seeds as compared to the healthy seeds, especially in susceptible cultivars as against resistant cultivars. The shriveling of seed in these plants may also have contributed towards the reduction in 1000-grain weight and corresponding reduction in germination.

**Table 1. Initial laboratory germination and 1000-seed weight of healthy and inoculated seeds in 2000-01 and 2001-02**

| Cultivars | 2000-01 | | | | 2001-02 | | | |
|---|---|---|---|---|---|---|---|---|
| | Healthy seeds | Inoculated seeds | Total reduction | % reduction | Healthy seeds | Inoculated seeds | Total reduction | % reduction |
| Initial germination (%) | | | | | | | | |
| Sonalika | 90.00 | 76.33 | 13.67 | 15.19 | 91.67 | 80.33 | 11.34 | 12.37 |
| PBW-65 | 92.33 | 88.33 | 4.00 | 4.33 | 94.00 | 90.00 | 4.00 | 4.26 |
| PBW-343 | 88.33 | 78.00 | 10.33 | 11.69 | 90.00 | 81.33 | 8.67 | 9.63 |
| VL-421 | 89.67 | 83.67 | 6.00 | 6.67 | 91.00 | 86.67 | 4.33 | 4.76 |
| HD-2687 | 87.33 | 76.00 | 11.33 | 12.97 | 88.33 | 79.33 | 9.00 | 10.19 |
| 1000-seed weight(g) | | | | | | | | |
| Sonalika | 30.0 | 26.33 | 3.67 | 12.23 | 29.80 | 26.42 | 3.38 | 11.34 |
| PBW-65 | 33.33 | 31.67 | 1.67 | 5.01 | 34.30 | 32.91 | 1.39 | 4.05 |
| PBW-343 | 30.67 | 27.33 | 3.34 | 10.89 | 31.37 | 28.17 | 3.20 | 10.20 |
| VL-421 | 27.67 | 26.00 | 1.67 | 6.04 | 28.07 | 26.45 | 1.62 | 5.77 |
| HD-2687 | 29.33 | 27.33 | 2.00 | 6.82 | 30.28 | 27.83 | 2.45 | 8.09 |
| | | SEm± | CD(P=0.05) | | | SEm± | CD(P=0.05) | |
| Initial germination | | 0.80 | 2.36** | | | 0.45 | 1.33** | |
| 1000-seed weight | | 0.35 | 1.03** | | | 0.33 | 0.97** | |

**Table 2. Peduncle length (cm) and number of tillers per plant in healthy and diseased plants in 2000-01 and 2001-02**

| Cultivars | 2000-01 | | | | 2001-02 | | | |
|---|---|---|---|---|---|---|---|---|
| | Healthy seeds | Inoculated seeds | Total reduction | % reduction | Healthy seeds | Inoculated seeds | Total reduction | % reduction |
| Peduncle length | | | | | | | | |
| Sonalika | 35.46 | 25.54 | 9.92 | 27.98 | 33.33 | 24.37 | 8.96 | 26.80 |
| PBW-65 | 39.04 | 34.20 | 4.84 | 12.40 | 37.33 | 31.75 | 5.58 | 14.95 |
| PBW-343 | 35.53 | 27.13 | 8.40 | 23.64 | 32.67 | 25.73 | 6.94 | 21.24 |
| VL-421 | 23.98 | 21.90 | 2.08 | 8.67 | 21.67 | 20.04 | 1.63 | 7.52 |
| HD-2687 | 28.57 | 23.10 | 5.47 | 19.15 | 27.33 | 21.63 | 5.70 | 20.86 |
| Number of tillers per plant | | | | | | | | |
| Sonalika | 3.67 | 2.33 | 1.34 | 36.51 | 4.00 | 2.67 | 1.33 | 33.25 |
| PBW-65 | 5.00 | 4.33 | 0.67 | 13.40 | 5.33 | 4.50 | 0.83 | 15.57 |
| PBW-343 | 4.00 | 3.00 | 1.00 | 25.00 | 4.33 | 3.33 | 1.00 | 23.09 |
| VL-421 | 3.00 | 2.67 | 0.33 | 11.00 | 3.00 | 2.67 | 0.33 | 11.00 |
| HD-2687 | 3.33 | 2.33 | 1.00 | 30.03 | 3.67 | 2.67 | 1.00 | 27.25 |
| | | SEm± | CD(P=0.05) | | SEm± | | CD(P=0.05) | |
| Peduncle length | | 0.24 | 0.71** | | 0.26 | | 0.77** | |
| No.of tillers/plant | | 0.26 | 0.77** | | 0.29 | | 0.86** | |

The manifestation of infection by pathogen in the host was also recorded in terms of peduncle length (cm) and number of tillers in diseased plants. It was observed that due to the disease incidence the peduncle length was reduced in all cultivars under study. However the reduction was more apparent in susceptible cvs. as compared to resistant cultivars. The maximum reduction in peduncle length was recorded in the susceptible cv. Sonalika (27.98 and 26.80%) while minimum reduction in peduncle length was observed in resistant cv. VL-421 (8.67 and 7.52%) respectively in the year 2000-01 and 2001-02 (Table 2). The reason for reduction in peduncle length is not yet been established. The reduction in height of peduncles may result in the height of the tillers; which may manifest due to the cessation of cell elongation in peduncle area in wheat plants [4, 5]. Reduction in peduncle length of infected plant in dwarf cultivar has also been reported [6, 7]. It was observed that there was a reduction in number of tillers in diseased plant as compared to healthy plants of the same cultivars. The maximum reduction was recorded in susceptible cvs. Sonalika (36.51% and 33.25%) while minimum reduction was found in resistant cultivars VL-421 in 2000-01 and 2001-02 respectively (Table 2). It has been noted that total number of tiller/plant and peduncle length (cm) were reduced in infected plants in all the cultivars. It is further observed that such reduction was more apparent in susceptible cultivars than resistant ones. The reduction in number of tillers in diseased plant may be attributed to several factors such as spacing, irrigation, and tillage and fertilizer application

besides genetic factors apart form the mycelial growth in stem primordial obstructing the tiller formation. Similar trend of reduction in number of tillers in diseased plants has also been observed [8]. Though the disease is systemic in nature, not all the tillers in an infected plant were smutted. This has been attributed to the possibility of inability of the mycelium to remain stable, multiply and invade all the tillers till the ear emergence [8]. It has also been reported that smutted plants produce lesser number of tillers per plant [5]. It has also been observed that there is a reduction in number of tillers in case of diseased plants [6, 9]. Reduction in number of tillers in Sonalika variety due to loose smut incidence has been reported by earlier worker as well [10, 11]. It has also been found that smut had a retarding influence in height of dwarf variety while no significant effect was found in tall varieties. Similarly, reduction in tillering was also observed.

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