

Short Communication

Occurrence of *Fusarium* Head Scab in International and National Wheat Breeding Materials

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Abstract. The study reports some preliminary observations on the occurrence of *Fusarium* head scab (FHS) disease on wheat under natural conditions. These studies were conducted in nursery trials on the wheat varieties of national and international origin prior to their release for cultivation in Pakistan. During the test trial on 1471 nursery entries, covering varieties of international origin for early and advanced screening, the candidate varieties for national wheat programme, and the commercial varieties, all were noted to show 16% to 59% susceptibility to FHS. These observations have been identified as significant indicators for giving FHS the due status in the national wheat disease programmes, before approving the release of new wheat varieties for farm the field level cultivation.

Keywords: *Triticum aestivum*, *Fusarium* head scab, national wheat breeding, wheat variety screening

Bread wheat (*Triticum aestivum* L.) is the staple food and an important cereal crop in Pakistan's economy. Total acreage of wheat in Pakistan is about 8 million hectares but due to the effects of several factors, the national average yield has remained stagnant at around 2 t/ha during the last decade (ASP, 2003). A number of diseases are responsible for reducing its overall production in the country due to their ability to occur and infect the wheat crop in all growth stages and natural environments. Fifty diseases are reported to occur on wheat in Pakistan, which are considered to be of economic significance (Jiskani, 2001). Some rusts have overshadowed the significant losses caused by other diseases, such as head scab, or *Fusarium* head scab (FHS). The FHS is presently regarded as one of the most important fungal diseases affecting the wheat crop in North America, Europe, China and other parts of the world (Gilbert and Tekauz, 2000; Guo *et al.*, 1999; Miedaner and Schilling, 1997; 1996; Parry *et al.*, 1995). The annual crop losses have been estimated to exceed US \$1 billion on account of this disease (Meronuck, 1997; Leu, 1985). This disease, in Pakistan, has remained an unaddressed and neglected area of cereal pathology. FHS is caused by several species of *Fusarium* (Gilbert and Tekauz, 2000), which occur as soil inhabitants as well as saprophytes on the host crop residues (Wieses, 1987). In addition to causing scab, they also cause seed decay, seedling blight, and crown and root rot of wheat. The FHS disease is unique in its capability to adversely influence all the quantitative and qualitative aspects of the crop (Dowell *et al.*, 1999; Nightingale *et al.*, 1999; Dexter *et al.*, 1997; 1996; McMullen *et al.*, 1997; Gilbert and Tekauz, 1995; Charmley *et al.*, 1994; Bechtel *et al.*, 1985).

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Keeping in view the importance of FHS, careful field disease diagnosis and scouting was carried out on early and advanced wheat variety candidates, and the commercial bread wheat material by following the pictorial guide for field identification of wheat diseases and pests (Prescott *et al.*, 1986). These studies were conducted on immature heads of the crop, raised during 2001-2002 at the research farms of Nuclear Institute for Food and Agriculture (NIFA), Peshawar, Pakistan. Intermittent rains and humidity at the field experiment site provided ideal conditions for the build-up of local inoculum and subsequent development of FHS to reach the epidemic level. Under these natural conditions, preliminary observations on the development of FHS on the varieties cultivated at NIFA were recorded. Varieties under the early trial included three nurseries introduced from CIMMYT/ICARDA, which were International Bread Wheat Screening Nursery (IBWSN), Semi Arid Wheat Screening Nursery (SAWSN), and Wheat Observation Nursery for Drought (WON-D). A total of 859 lines were planted in these three nurseries in strips of adjacent plots. Each entry was planted in two rows of 2.5-m length with 30-cm distance. The advanced trial material comprised of 530 lines planted from National Wheat Disease Screening Nursery (NWDSN) in strips of adjacent plots, and each entry was grown in 1-m row plot at a 30-cm distance. The nursery included advanced lines from the wheat breeding programmes of the country. The candidate material included 40 upcoming future varieties, which were planted in replicated trials where each entry was planted in six rows, 30-cm apart with 5-m row length. The commercial material included the varieties released in the country, and each was planted in two rows of 2.5-m

length in strips of adjacent plots with 30-cm row-to-row distance.

Qualitative observations on the occurrence of FHS were recorded in two forms, which were the resistant response (when the entry was disease-free and no compatibility between the host and the pathogen was observed), and the susceptible response (when the entry was infected and disease symptoms were observed). These observations were recorded on 1471 wheat genotypes planted under four different groups. The FHS disease was noted to occur in all the four classes of the material evaluated (Table 1). Results showed that lowest number of susceptible entries (16%) were recorded in SAWSN introduced from ICARDA, while maximum infected entries (59%) were registered in NUWYT-N from the national wheat programme. The highest mean of the susceptible entries was recorded in the candidate variety material (47%), which was followed by the commercial variety group (36%), while in the case of the early and advanced trial materials, the mean of the susceptible entries remained upto 21%.

Results of this preliminary study have indicated that a considerable number of our commercial and upcoming varieties for the future, which are being currently tested under the national wheat improvement programme, were under serious

Table 1. Susceptibility of bread wheat material of different origin to the *Fusarium* head scab disease at the field trial nurseries of Nuclear Institute for Food and Agriculture (NIFA), Peshawar, Pakistan

Origin of wheat material (category-wise)	Test entries (number)	Susceptible entries (%)	Mean of susceptible entries by category (%)
Early trial varieties			
IBWSN- CIMMYT	410	21	21
SAWSN- ICARDA	309	16	
WON-D- ICARDA	140	25	
Advanced trial varieties (national wheat programme)			
NWDSN	530	18	20
Candidate varieties (national wheat programme)			
NUWYT-N	20	59	47
NUWYT-R	20	35	
Commercial varieties			
NIFA	42	36	36

threat from FHS. It is also suspected that the disease may be already causing serious losses, as currently it is the most neglected and unaddressed disease problem of wheat in Pakistan. Hence, there is a dire need to combat this disease, particularly so, as some of the current commercial varieties, such as Faisalabad-83, Inqilab-91, Perwaz-94, Saryab-92, Shaheen-94 and Kohsar-93 were found to be susceptible to FHS. Among these varieties, Inqilab-91 is the major wheat variety grown in NWFP, Pakistan, being cultivated on over 70% of the total wheat area (Kisana *et al.*, 2003). It is feared that whenever the weather became favourable for the growth of FHS, serious yield and quality losses may occur.

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