

Status of foliar diseases of wheat in Punjab, Pakistan

Atiq-ur- Rehman Rattu*, Shahzad Asad, Muhammad Fayyaz, * Muhammad Zakria, Shamim Iftikhar and Yasmin Ahmad

*Crop Diseases Research Program, Institute of Plant and Environmental Protection
National Agricultural Research Centre, Park road, Islamabad, Pakistan*

**Corresponding Author: rmzakria@hotmail.com*

Abstract

In the year 2009, a survey was conducted with the emphasis to ascertain the situation of foliar diseases of wheat in Punjab, Pakistan. Four diseases viz. spot blotch, powdery mildew, yellow and leaf rust were found prevalent. The disease index (DI) of spot blotch, yellow rust and leaf rusts was 24.8% 5.2% and 0.4%, respectively. Spot blotch was the most prevalent disease on varieties cultivated at farmer fields and no variety was found free of it. Maximum disease was observed on Bhakkhar-2001 followed by Inqilab-91, Faisalabad-08, Lasani-2008 and Seher-2006.

Keywords: Leaf rust, powdery mildew, spot blotch, wheat, yellow rust.

Introduction

Wheat occupies a position of paramount importance amongst world's crop plants both in extent of area and magnitude of food production. 30 different varieties of wheat are grown in Pakistan, of these, 22 are regarded as high-yielding and eight as low-yielding. There are many factors that influence the yield production of wheat. In Pakistan, 50 diseases are reported to occur on wheat (Anonymous, 2000) and are important economically. The fungal pathogens are of most significance and took a regular toll of the yield wherever wheat is sown in the country. The frequently occurring fungal diseases of wheat in Pakistan, are the rusts and smuts. However, blight/spot causing organisms also affect the wheat crop (Iftikhar *et al.*, 2006; Asad *et al.*, 2007; Iftikhar *et al.*, 2010)

Rusts, smuts and powdery mildew are most destructive and also the most widely recognized of wheat crop diseases. These diseases are frequently found in all every wheat growing areas of Pakistan. The record showed that there has been severe attack of black stem rust of wheat in 1906-1908 at Mirpurkhas, Sindh; yellow on stripe and orange or leaf rust of wheat in 1978 at all over wheat growing areas of Pakistan (Anonymous, 2000).

In Pakistan, foliar blight diseases of wheat are considered to be of minor importance. The observational data on diseases recorded in wheat breeding nurseries even did not include reports on blight diseases. Rusts are by and far, the diseases of major concern (Rattu *et al.*, 2009; Bux *et al.*, 2012). Foliar blight/spot blotch contribute

significantly to yields of wheat and some information is available (Iftikhar *et al.*, 2010a; Iftikhar *et al.*, 2010b; Iftikhar *et al.*, 2012). The wheat researchers from tropical and sub-tropical countries indicated *Cochliobolus sativus* as the most economically important foliar pathogen of spot blotch. Disease can be seed borne, airborne, causing secondary infection that result in severe foliar disease and yield loss. The secondary infection highly depends on environmental conditions, which requires high relative humidity. The leaf symptoms of spot blotch are most pronounced after heading and frequent on lower leaves, appeared as distinct, elongate, brown-black lesions that rarely exceed 1 cm in diameter (Duczek, 1997; Bello *et al.*, 2003). The losses due to spot blotch ranged from 10-25% in Nepal, Bangladesh and India (Malaker *et al.*, 1994; Karwasra *et al.*, 1998; Ruckstuhl, 1998) whereas in China it was considerably larger up to 60% (Chang and Yousan, 1998).

In the year 2009, there was a huge hue and cry about a disease on wheat crop especially in Southern Punjab on variety Bhakkhar-2001. Therefore, a survey was conducted with the emphasis to ascertain the situation in Punjab wheat growing areas of Pakistan for rusts, foliar blight and powdery mildew.

Materials and Methods

Surveys of major wheat growing agro-ecological zones of Punjab, Pakistan were conducted to determine the incidence, prevalence and severity of rusts, foliar blight and powdery mildew, during 2009.

Disease assessment was done in the field. Plants were assessed for disease symptoms by entering into the fields. Disease prevalence and incidence was recorded as described by Iftikhar *et al.* (2006). To determine disease severity for foliar blights, a 0-5 scale was used (IRRI, 1996). Whereas for rusts and powdery mildew 0-9 scale was used (Peterson *et al.*, 1948). In addition the disease index (DI) was also calculated by putting the collected data from the field into following formula:

$$DI \% = \frac{0(\text{Plants in Cata.0}) + 1(\text{Plants in Cata.1}) + 2(\text{Plants in Cata.2}) + 3(\text{Plants in Cata.3})}{\text{Total Foliage samples}} \times 100$$

Maximum of the scale (9 in case of PM & Rusts and 5 for Spot blotch (SB)

Diseased leaf samples were collected and brought in the laboratory of Crop Diseases Research Programme (CDRP), Institute of Plant and Environmental Protection (IPEP), National Agricultural Research Centre (NARC), Islamabad, Pakistan. Isolation, identification and pathogenicity of collected samples/pathogens was done by test tube cotton swab method (Giri *et al.*, 2001).

Results and Discussion

Results showed that amongst the different fungal diseases, maximum prevalence (60%), incidence (51%) and disease index (21.8%) was recorded for spot blotch followed by yellow rust, leaf rusts and powdery mildew (Table.1).

Table 1: Prevalence, incidence and disease index of different foliar diseases of wheat in Punjab during 2009

Disease	Prevalence (%)	Incidence (%)	Disease Index (%)
Spot blotch	60.0	51.0	24.8
Yellow rust	33.0	27.0	5.2
Leaf rust	6.0	6.4	0.4
Powdery mildew	18.0	17.0	3.6

Five commercial wheat varieties viz. Bhakkhar-2001, Inqilab-91, Seher-2006, Faisalabad-08 and Lasani-2008 were dominant in field. The prevalence of spot blotch was 100% on all the fields wherever Bhakkhar-2001 was cultivated, whereas the prevalence on Inqilab -91, Seher-2006, Faisalabad-08 and Lasani-08 was 14%, 3%, 10% and 5%, respectively. However, yellow rust, leaf rust and powdery mildew did not prevailed on Bhakkhar-2001. The prevalence of spot blotch on Inqilab-91 was 14%, 30% for yellow rust, 6% for leaf rust and 31% for powdery

mildew. Cultivars Seher-2006, Faisalabad-08 and Lasani-08 were found free of any rust and powdery mildew (Table.2).

The incidence of spot blotch was 91% on Bhakkhar-2001 and 16 % on Inqilab-91 while it was 10 % on rest of the varieties. On Inqilab-91 an incidence of 52 % was calculated for yellow rust while it was 0.7 % and 37 % for leaf rust and powdery mildew respectively. The severity range for spot blotch on Bhakkhar-2001 was 1-5. Whereas on Inqilab-91 spot blotch severity ranged between 0-1, while that of yellow rust, leaf rust and powdery mildew it was observed 1-2, 0-1 and 1-5 respectively. (Table.2).

Pathogenicity test

The pathogenicity of the isolates of *Bipolaris sorokiniana* collected from different locations was confirmed using test tube cotton swab method thus confirm the Koch's postulates.

The results revealed that 4 diseases viz. spot blotch, powdery mildew, yellow and leaf rusts were prevalent in the surveyed areas. Yellow rust, leaf rust and powdery mildew are known to occur in wheat crop in mild to severe form as a regular feature depending upon the climatic conditions and the genotype cultivated at farmer fields. Therefore the main focus of discussion will be the spot blotch, which showed high prevalence during 2009 wheat growing season. Maximum disease was observed on Bhakkhar-2001 followed by Inqilab-91, Faisalabad-08, Lasani-2008 and Seher-2006. The diseased leaf samples collected from different fields indiscriminately yielded *B. sorokiniana* upon isolation. This was followed by pathogenicity test and all the isolates were found strongly pathogenic.

Spot blotch is not new in Pakistan, previously this disease was reported to cause by *Helminthosporium* in Sindh (Bhatti and Ilyas, 1986; Hafiz, 1986). During a survey in spring 2000, the pathogens responsible for foliar blight (*Bipolaris sorokiniana*, *Drechslera tetramera*, *Pyrenophora tritici-repentis*, *Alternaria alternata* and *Stemphylium* sp.) were observed in different frequencies in various districts of Punjab (Iram and Ahmad, 2004). In surveys of Punjab and NWFP conducted during 2004 and 2005, no wheat growing zone was found free from foliar blight. In Punjab disease was present in zone 5 (Southern Punjab), zone 6 (Central Punjab) and zone 7 (Northern Punjab). In NWFP it was present in zones 9 and 10 (Iftikhar *et al.*, 2006). Similar situation was observed during the year 2006, 2007 and 2008. A number of samples were collected

which revealed *B. sorokiniana* upon isolation (Asad *et al.*, 2007; Iftikhar *et al.*, 2010).

This is worth mentioning that after the yellow rust susceptibility of Inqilab-91 due to the break down of resistant gene Yr27, an epidemic in 2005 occurred, since then the farmers has started looking for the replacement and Inqilab-91 was replaced by Bhakkhar-2001. In 2009, 30 to 40% area in the region was covered by Bhakkhar-2001. According to Aggarwal *et al.* (2000) weather conditions (high moisture and optimum temperature at the terminal crop stage) play a key role in exposing the crop to leaf blight. Such conditions can cause epidemics in regions where

leaf blight is regarded as a minor disease. It seems that apart from the favorable environmental conditions i.e. mean temperature, 24°C, and frequent rains (according to Meteorological data Department, Multan) in the month of March, the available seed to the farmers for the last four years might be the reason of inoculum development and disease dissemination. Pathogen causing spot blotch is now well established in Khyber Pakhtoon Khawa and Punjab. This is an alarming situation for epidemic of spot blotch as has been observed in South Asia (Jagdish *et al.*, 2002; Singh *et al.*, 2002).

Table 2: Prevalence, incidence and severity of different foliar diseases of wheat on commercial varieties cultivated at the farmer field during 2009.

Varieties	Prevalence (%)				Incidence (%)				Severity range (0-5)** (0-9)			
	SB*	YR	LR	P.M	SB*	YR	LR	P.M	SB*	YR	LR	P.M
Bhakkhar -2001	100	0	0	0	91	0	0	0	1-5	0	0	0
Inqilab-91	14	30	6	31	16	52	0.7	37	0-1	1-2	0-1	1-5
Seher	3	0	0	0	10	0	0	0	0-1	0	0	0
Faisalabad-08	10	0	0	0	10	0	0	0	0-2	0	0	0
Lasani	5	0	0	0	10	0	0	0	3-5	0	0	0

*SB: Spot Blotch, YR: Yellow Rust, LR: Leaf Rust, PM: Powdery Mildew

** (0-5) used for rating Spot Blotch.

(0-9) used for rating Yellow rust, Leaf rust & Powdery mildew.

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