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SPOT BLOTCH OF WHEAT IN DIFFERENT AGRO-ECOLOGICAL ZONES OF PAKISTAN

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Abstract

Surveys for foliar blight with special reference to spot blotch caused by *Bipolaris sorokiniana* were conducted to monitor the disease situation during 2005, 2006 and 2008 in different wheat growing zones across Pakistan. Among 8 different agro-ecological zones, the maximum disease (26.8) with highest incidence (84%) and severity (2.5) has been observed in zone 6 (Punjab area) during 2005 which was adjoining the zone 5 in geographic location. The disease situation decreased in the coming seasons and even in 2008 similar disease levels were not observed in these zones (5 and 6). Similar picture was found in other zones (3, 4, 7 and 9) except zone 10 and 11 (Northern Area) where disease was increased in 2008 as compared to the previous years. The situation was just because of the abnormal weather conditions prevailed in different years in different zones of Pakistan and replacement of commercial variety during the course of the time.

Introduction

In Pakistan wheat crop is affected by a number of diseases. Among diseases induced by fungal pathogens, foliar blight causing fungi are considered to contribute significantly to low average yields of the crop (Aftabuddin *et al*., 1991).The foliar diseases pose varying levels of threats to the production of wheat in different agro-ecological zones of the country. Earlier studies on foliar blights inciting pathogens in the rice-wheat cropping system of Northern Punjab revealed that *Bipolaris sorokiniana, Drechslera tetramera, Pyrenophora tritici-repentis, Alternaria alternata* and *Stemphylium* sp., are the major foliar pathogens of wheat (Iram & Ahmad, 2004). In Southeast Asia the most frequently isolated fungus is *B. sorokiniana* (Alam *et al*., 1994; Sharma *et al*., 1996) and is associated with warm and humid climates (Fisacher, 1985). The spot blotch causing pathogen is found most frequent in Bangladesh and currently becoming the major limitation for wheat cultivation in that country (Alam *et al*., 1994). The pathogen is named as a silent killer of the wheat crop as its losses are not well estimated in this part of the world compared to the rusts. *Bipolaris sorokiniana* is most frequently associated with poor germination and abnormal seedlings of wheat (Ammara *et al*., 2001). Due to this pathogen, the seed germination and seedling emergence significantly decreases with increasing of black pointed seeds, observed in studies conducted in Bangladesh (Hossain & Hossain, 2001) and in China (Song *et al*., 2001). In north eastern and north western plains of India the yield losses ranged from 27%-56.6% during 1998-1999 (Satvinder *et al*., 2002; Singh *et al*., 2002), 15% was observed on several farms in Bangladesh (Alam *et al*., 1994) and 23.8% in Nepal (Shrestha *et al*., 1997).

In Pakistan foliar blight of wheat was considered to be of minor importance (Bajwa, 1985; Bhatti & Ilyas, 1986; Hafiz, 1986) because the observational data on the diseases

recorded in wheat breeding nurseries did not include even reports of the blight diseases (Bajwa, 1985). Previously the pathogen was observed only in few districts of Sindh (Bhatti & Soomoro, 1996) Later the wide occurrence of foliar blights caused by *B. sorokiniana* has been observed during survey of major wheat growing areas of Pakistan (Iftikhar, 2004).The increased occurrence of the pathogen in different agro-ecological zones has thus necessitated the regular monitoring of the disease. The present study is the follow up of surveys conducted during three years (2005, 2006 and 2008) to monitor the disease situation in different agro ecological zones of Pakistan.

Materials and Methods

Surveys and samples collection: Surveys were conducted during 2005, 2006 and 2008 in different agro ecological zones of Pakistan (Fig. 1). In Sindh Area, zone 3 include Southern regions while zone 4 includes Northern regions. In Punjab Area, zone 5 includes Southern Punjab, Zone 6 Central Punjab and Zone 7 Northern Punjab. While in North Western Frontier Province (NWFP) Zone 9 includes Foot hill areas, Zone 10 Uplands of NWFP and Zone 11 Foot hill areas of Gilgit and Sukardu. During, 2005 twenty three locations were visited in zones 3 and 4, fifty eight locations in zone 5, 6 and 7 and 42 locations were visited in zone 9 and 10 and 48 samples were collected from 48 locations of zone 10 and 11 (Fig. 1).

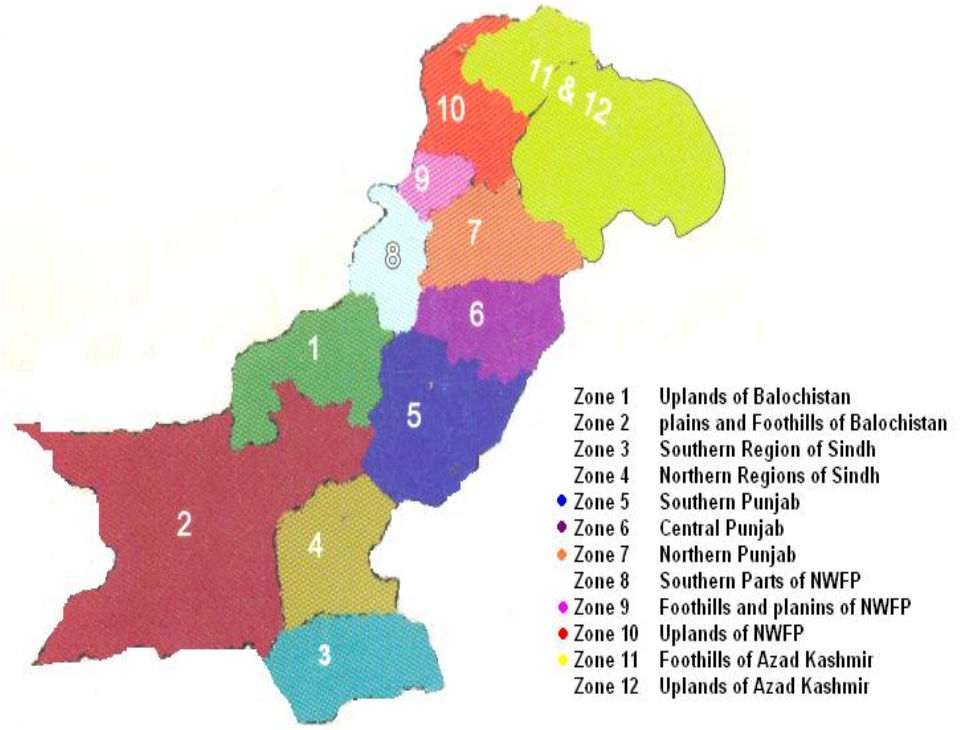

Fig. 1. Wheat production agro-ecological zones of Pakistan.

The disease was assessed at each location on visual symptom basis and sampling was done by taking the leaf samples at 10 points diagonally in each field and later formed a composite sample. During 2006, seventy five locations were visited in zone 3 and 4. Fifty six locations were surveyed in zone 6 and 7, while in zone 9 and 10, 39 locations were surveyed and 26 locations were visited in zone 10 and 11. During 2008, total 13 locations were visited in Punjab Area. Out of which 4 locations were in zone 5, five in zone 6 and four were in zone 7, whereas in zone 9 two locations were visited. While 8 locations in zone 10 and 10 locations in zone 11 of Northern Areas were surveyed. Disease assessment was calculated by using the following formula:

$$\text{Prevalence \%} = \frac{\text{Locations showing foliar spots}}{\text{Total locations}} \text{ X } 100$$

$$\text{Incidence \%} = \frac{\text{Number of samples showing foliar spots}}{\text{Total Number of samples}} \text{X } 100$$

Disease severity was assessed on visual rating scale i.e. 0-5 scale, where 0 = no symptom, 1 = 1-5% few spots on < 50% of leaves, 2 = 5-20% spots on < 50% of leaves, 3= 5-20% spots on > 50% of leaves 4=20-50% spots on < 50% leaves and 5 = > 50% on > 50% leaves (Anon., 1996).

$$\text{D.I \%} = \frac{\text{Disease index [Foliar in scale 1]+[Foliar in scale 2].....+[Foliar in scale 5]}}{\text{Total foliar samples}} \text{ x } \frac{100}{5}$$

Isolation and identification: The foliar samples showing diseased spots were cut into small pieces (approx 4-5 pieces). The leaf sections were first surface sterilized by dipping in 1% Sodium hypochloride solution (NaOCl) for a minute and later was rinsed with sterilized distilled water and then plated on wet filter paper placed already on the bottom of sterilized Petri-plate. Plates were incubated for 24 hours at 20-22ºC under photoperiod and then 24 hours at 18ºC in dark period (De Wolf *et al.*, 1998). Upon the fungal growth, slides were made and identification was done under light microscope at 40 x magnification for confirmation of the spot blotch organism.

Results and Discussion

Bipolaris sorokiniana was prevalent in all wheat growing zones (3, 4, 5, 6, 7, 9, 10 and 11) during 2005 with different frequencies in contrast to previous reports in Pakistan in which the spot blotch was confined to the Southern province of Sindh only where winter temperatures are warmer (Bhatti & Ilyas, 1986; Hafiz, 1986), while our results reflect the increase in the occurrence to the other major wheat production zones. This shows the adaptability of the pathogen to spread in those areas even where the winters are not too warm compared to Sindh. This trend has also been reported by Diman *et al.*, (1994) that spot blotch has begun to dramatically expand to more moderate and temperate regions of irrigated rice-wheat system such as the vast Central and Northwestern regions of the Indian subcontinent This might be due to pathogen adaptation, changes in virulence spectrum, growing of susceptible cultivars, use of reduced or no till tillage practices and/or changes in climates. Similar situation was recorded during the second year (2006) as well. However the two zones 3 and 4 in 2008 could not be visited. The disease was not found in zone 5 and 6 during 2008 (Table 1) mainly due to the very harsh climatic conditions during the growing season with the temperature falling below freezing point for almost 23 days during the heading stage.

The highest prevalence 75% of spot blotch in zone 3 was observed during 2005 followed by 62.5%, 62.5% and 60% in zone 5, 11 and 6 respectively whereas, the highest percent of spot blotch prevalence 53% was calculated in zone 10 during 2006 compared to 100% during 2008 which shows progressive increase of the disease in the same zone and that was followed by 84.62% in zone 11 of Northern areas (Table 1).This increasing trend of the disease in that particular zone attributed mainly because of the conducive climatic conditions which were quite different in 2008 as compared to previous years. Another reason of this disease increase in these zones seems to be the non replacement of the variety (Inqualib-91) which showed susceptibility during 2005 against rusts and the foliar blights (Anon., 2006). On the other hand the gradual decrease of the disease prevalence in Punjab (zone 5 and 6) has been observed which comes to zero level during 2008 (Table 1). The reason was mainly due to the fact that on a major area of these zones the variety Inqualib-91 was replaced by another variety Bhakkar-2001. The similar pattern was observed in these zones regarding the incidence and disease index because of the same reasons. The maximum severity (2.5) in zone 6 during 2005, severity 2 in zone 6, 9, 10 and 11 during 2006 and 1 in zone 11 was observed during 2008. The highest disease index (26.8) was found in zone 6 followed by zone 7 and 6 during 2005 (Table 1). During 2006 maximum disease was in zone 7 followed by zone 6 and 3. Whereas the highest disease index (9.23) was found in zone 11 followed by zone 10 during 2008. Similar trend of disease between the zones 5, 6, 7 and 9 have been observed in previous years of 2004 and 2005 (Asad *et al*., 2008) because of the abnormal weather conditions prevailed in different years, which played a critical role in predisposing the crop to leaf blight problem including high moisture and temperature (Fisacher, 1985).These conditions can cause epidemics where the leaf blight was considered to be of minor importance (Aggarwal *et al*., 2000). The disease situation in Northern areas was quite different in the third year observations, which is just because of hot summer during 2008. The similar observation was recoded by Mercado *et al*., (2003) who reported the variation in the frequency of the foliar pathogen between the years and even during a single growing season according to climatic conditions. The disease increase may also be attributed to the fact that the majority of the farmers are still growing the susceptible variety Inquliab-91 in that area. The disease has shown variations in its occurrence broadly due to the two reasons viz., the environmental conditions and the varietals pattern followed in the different agro-ecological zones, yet it can be said that the pathogen has progressed from the warmer winters to the comparatively tropical zones also. Thus the disease can become an emerging problem in future in some zones which needs to be monitored on regular basis.

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