

## Incidence of yellow stripe rust in wheat growing areas of Lahore

\*Muhammad Ali<sup>1</sup>, Muhammad Shahbaz<sup>2</sup>, Ahmad Ali Shahid<sup>1</sup>, Muhammad Asif<sup>1</sup> and Adnan Zahid<sup>1</sup>

<sup>1</sup>Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan.

<sup>2</sup>Pest warning and quality control, Agriculture department, Government of the Punjab, Lahore, Pakistan.

\*Corresponding author's email: muhammadali.mycologist@gmail.com

### Abstract

A survey of different wheat growing areas in and around Lahore, Pakistan was conducted to study the incidence of yellow stripe rust on wheat crop during 2013. The areas surveyed for this purpose included Bedian Road, Barki Hadiara Road, Mamala Lahuwali, Padana, G.T Road Awan Dhaianwala, Jandiala Ganjay Sindhwa and Marl Mari. Samples were collected from highly infected fields during survey. Sehar, Faisalabad-2008, Inquilab-91 and Millat varieties of wheat were inspected, and it was observed that the incidence of rust was variable on each variety. The disease appeared on all varieties and its percentage incidence was recorded as 65%, 55%, 40% and 25% on Sehar, Faisalabad-2008, Inquilab-91, and Millat, respectively. During the field visits pustules of citron yellow colour were observed on the leaf surfaces as long stripes and were hardly found on shoot and heads. As the crop reached maturity, yellow spores were formed in the stripes and cover whole epidermis of the leaf. Morphological characteristics under microscope showed the presence of urediospores and teliospores.

**Key words:** Disease incidence, Faisalabad-2008, Inquilab, Millat, Sehar, *Triticum aestivum*, yellow stripe rust.

### Introduction

Plants contribute 93% of world human food and the cereals occupy dominating position. The main part of cereal production pooled by wheat, maize and rice. Wheat (*Triticum aestivum*) is grown in about 28 countries and it is the largest cultivating crop among all the cereals (Afzal *et al.*, 2008). Production and quality of the wheat crop is linked with the world food security, and more than 80% of the global population rely on wheat as a fraction of their daily diet (Ahmed *et al.*, 2012). Wheat production is inhibited by over 50 different biotic and abiotic stresses (Anonymous, 2000). Biotic factors especially fungal pathogens are considered most important. The frequently occurring fungal diseases of wheat are rusts, smuts, blights and leaf spots (Iftikhar *et al.*, 2010). Rust diseases of wheat are of most significance that ravages this crop since ancient times. Three wheat rusts namely stripe or yellow rust (*Puccinia striiformis tritici*), leaf or brown rust (*Puccinia triticina tritici*) and stem black rust (*Puccinia graminis tritici*) are known.

Yellow stripe rust is most significant than all other types of rusts, while infects the wheat plant at low temperature and wet weather (Johnson, 1992; McIntosh *et al.*, 1995; Boyd, 2005). Gadd in

1977, reported the epidemic of yellow stripe rust of wheat in Europe, nevertheless this epidemic occurred in advance to the usage of wheat crop as food (Eriksson and Henning, 1896). Line (2002) described yellow stripe rust of wheat and its geographical dispersal over the globe. This disease remained a major risk to the wheat crop production in different wheat growing areas especially in Asia. According to agricultural reports this disease has influence the wheat production over an area of 43 million hectare. Globally the incidence and prevalence of this disease has caused 30-100% loss in grain production and therefore became a major threat to the wheat crop (Chakravarty, 2011). Seldom on the leaf surface and frequently on the stem and head, symptoms become visible as citron yellow (uredia). With the passage of time black spore are formed on the stripes covered with leaf epidermis (Smiley and Cynthia, 2003). Disseminating ability of the wheat rust spores make it easier to move and spread all around (Kolmer, 2005). Flexibility for changing in environmental conditions enable them to survive in harsh conditions, make them enable to further reproduce by different means (Johnson, 1992; Kolmer, 2005; Jin *et al.*, 2010). In this way it, effects crops negatively by destroying

its generative system, foliar portions, diminutive plant growth, and dried-up grains with poor quality (Line, 2002; Chen, 2005). For inhabitants of Pakistan wheat is the primary food item. Wheat cultivation occupies maximum area of 8.303 million hectares, engaging 33% of cultivated area and yields 21.7 million tons (Anonymous, 2006). Out of 8.303 million hectare 5.8 million (about 70%) is disposed to stripe rust. Foothills of Pakistan's Northern areas and some area of Balochistan severely attacked by stripe rust that develop into epidemics if favorable conditions are available. Pakistan has faced rust epidemics of wheat in 1947-1948, 1953-1954, 1958-1959, 1977-1978, 1992-1993 and some mild epidemic 1972-1973 and 1975-1976. Different wheat varieties were effected severely by the rust (Khan and Mumtaz, 2004). Current study was aimed at the evaluation of disease occurrence, disease incidence and prevalence of stripe rust on different wheat varieties in wheat growing areas of Lahore region Pakistan.

## Material and Methods

### Survey and Sample collection

A survey was conducted with the collaboration of Institute of Agricultural Sciences, University of the Punjab and Department of Pest Warning and Quality Control, Directorate of Agriculture Lahore, of different wheat growing areas in and around Lahore, to study the rust incidence on wheat crop during February 2013. The areas surveyed for this purpose include Bedian Road, Barki Hadiara Road, Mamala Lahuwari, Padana, G.T Road Awan Dhaianwala, Jandiala Ganjaj Sindhwa and Marl Mari. These are reported as key areas with respect to wheat cultivation. Fields were inspected and samples were collected which were highly infected with the yellow stripe rust. Different varieties of wheat were inspected in this regard and it was observed that the incidence of rust was variable on each variety. Following were the main varieties which were grown and inspected for the purpose; Sehar, Faisalabad 2008, Inquilab 91 and Millat.

These varieties were found with variable infection. Samples were collected in polythene bags and were properly labelled with the date and site of collection. All the collected samples were brought to the Fungal Culture Bank situated at the Institute of Agricultural Sciences, University of the Punjab, Lahore for further processing. Disease incidence for different wheat varieties was calculated by applying the following formula;

$$\text{Disease incidence} = \frac{\text{Number of infected plants}}{\text{total number of plants visited}} \times 100$$

## Results

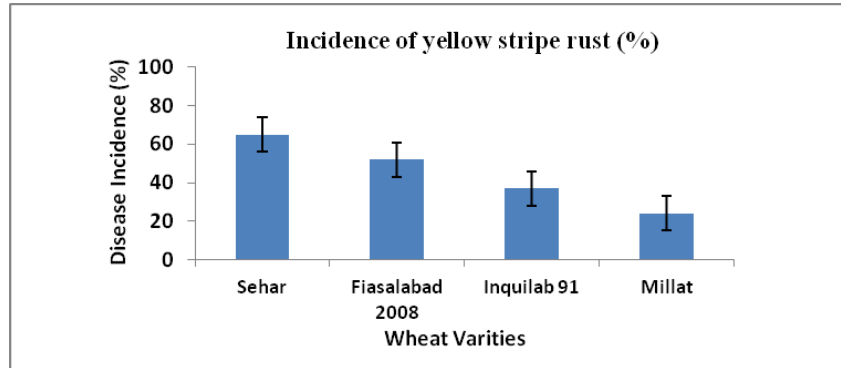
The survey depicted that stripe rust has different incidence ratios at different sites. Similarly some varieties exhibited severe incidence values while others represented lesser values. The variety of wheat, Sehar showed the highest incidence of stripe rust. Sehar and Faisalabad 2008 represented the incidence values of 65% and 55%, respectively (Fig. 1). It was observed that stripe rust of wheat, appeared with less severity on Inquilab 91 and Millat, with incidence values of 40% and 25%, respectively. During the field visits pustules of citron yellow (uredia), were observed on the leaf surfaces as long stripes and were hardly existing on shoot and heads. As the crop matures these spores develop in the form of stripe and cover whole of the epidermis. The samples of stripe rust were observed in laboratory for its morphological characteristics under microscope which showed the presence of urediospores as well as teliospores.

## Discussion

Four commercial wheat varieties Sehar, Faisalabad 2008, Inquilab 91 and Millat were dominant in the field. The incidence of stripe rust among Sehar, Faisalabad 2008, Inquilab-91 and Millat were 65%, 52%, 37% and 24%, respectively. Rattu *et al.* (2011) recorded 52% stripe rust incidence on Inquilab-91, which resulted in break-down of resistant gene Yr-27 in it resulted in its replacement with Bhakhar-2001. Some more plant pathologists have piloted experiments and field trials on wheat yellow stripe rust in order to find a link between incidence and disease and reduction in crop production. The sudden upsurge in the incidence of disease on Inquilab-91 because of vulnerability of this particular variety was associated with heavy rainfall during the growing season of crop. It has been recognized that on three disease causing factors infection efficiency, sporulation capacity, lesion expansion rate, latent period and infectious period, were most significant factors, yet, the infection is highly effected by the climatic conditions and level of primary inoculum (Luo and Zeng, 1995). At the jointing stage, the fungus primarily infects leaves which appeared in rows somewhat linearly along the axis of the leaf. However, infection appears on the spike and stem of wheat at the filling and milky stages. Finally, the pathogen overcomes the host and the fungal urediospores rupture through the surface of the

leaf, stem, or spike tissues. In addition, as stripe rust destroy the chlorophyll pigment and foliar structure of wheat, the nutrient accumulation for normal growth was reduced, and it was advanced with maturity (Afzal *et al.*, 2008). According to Salman *et al.* (2006), it became clear that the losses in crop production have augmented respectively with the high level of disease severity in the field. Some more plant pathologists have also reported the similar results that the wheat varieties which show the slow rust infection

resulted in more crop production as compared to those varieties which have rapid spread of infection. Therefore, comparing the above described results, it is obvious that there is much need to escape vulnerable and rapid rusting varieties of wheat. Moreover, plant breeding sectors must be stimulated to constantly observe rust condition through Plant Pathologists and develop resistant varieties thus certifying viable food security of the country.



**Fig. 1:** Incidence of yellow stripe rust on different wheat varieties in Lahore.



**Fig. 2:** Yellow stripe rust on wheat (Left column; Sehar, Right column; Faisalabad 2008) in Lahore.

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