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RESEARCH ARTICLE

PREVALENCE OF STRIPE RUST DISEASE IN WHEAT UNDER RAINFED CONDITIONS IN JAMMU REGION

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ABSTRACT

Stripe rust (yellow rust) caused by *Puccinia striiformis* West. f. sp. *tritici* is one of the main constraints in realizing the genetic potential of most of the cultivated varieties both in respect of yield and grain quality. The wheat growing areas of Jammu region i.e. Reasi, Udhampur and Rajouri were surveyed to ascertain the distribution of stripe rust, during *Rabi* seasons of 2013-2014, 2014-2015 and 2015-2016. During 2015-2016, Reasi district recorded the maximum disease severity i.e 14.2% in the range of 12.8 to 14.2 % due to higher temperature. The minimum disease severity was found in 2013-2014 in the range of 10.5 to 11.8% due to perhaps low temperature was found in the region. Low yield of wheat crop was due to lack of availability of high yielding varieties of wheat in the district and infestation of stripe rust disease in the region.

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INTRODUCTION

Wheat (*Triticum* spp.) belongs to the genus *Triticum* of the Poaceae family originally from the Levant region of the Near East and Ethiopian Highlands, but now cultivated worldwide. India achieved the feat of "deficit to surplus" status with the introduction of Mexican dwarf wheat that brought the great Green revolution in India during the sixties. One third of the Indian population depends on wheat as their main food. India is the second largest producer of wheat after China claiming the position of a significant stakeholder in Global wheat production. During the XI plan period (2007-08 to 2011-12), the country experienced steep increase in total food grains production. Being one of the major contributors of country's total food grains production, wheat production was recorded to be 93.5 million tonnes reaped from an area of 29.65 million ha with productivity level of 3119 kg/ha. Wheat (*Triticum* spp.) is the second most important winter cereal in India after rice. The share of Wheat in total food grain production is around 36.25% and share in area is about 24.83 % of the total area under food grains.

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Wheat is grown in India on an area of about 31.18 Million ha. with a production of 95.91 Million tonnes and productivity of 3.1 t/ha (2013-14). About 99.5% of the wheat production comes from Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan, Bihar, Maharashtra, Gujarat, Karnataka, West Bengal, Uttarakhand, Himachal Pradesh and Jammu & Kashmir and remaining contributed by rest of the States. The total production increased to the magnitude of more than six folds from roughly 12.3million metric tons in 1964-65 to an estimated 95.85 million metric tons in 2013-14. This feat was achieved as a result of a strong research back up that facilitated the development of improved high yielding varieties of wheat resistant to diseases with stable performance. The problems of Yellow Rust of Wheat have been a great threat to Wheat as it may be adequately stated that "More yield more threats of Rust".

Out of various biotic factors, stripe rust (yellow rust) caused by *Puccinia striiformis* West. f. sp. *tritici* is one of the main constraints in realizing the genetic potential of most of the cultivated varieties both in respect of yield and grain quality. Mono-culture of wheat cultivars coupled with broad adaptation of the pathogen to diverse climatic conditions and emergence of new pathotypes, make the disease a matter of great concern (Kolmer, 2005).

Table 1. Prevalence of Stripe rust disease in wheat in Reasi, Udhampur and Rajouri districts (J.&K.)

| S.No. | Varieties | Yield (qt/ha) 2013-14 | Yield (qt/ha) 2014-15 | Mean Yield (qt/ha) | Net Return (Profit) in Rs. / unit | C:B Ratio |
|-------|------------------------------|-----------------------|-----------------------|--------------------|-----------------------------------|-----------|
| 1. | Farmer practice (local var.) | 14 qt/ha | 13.2 | 13.60 | 9870 | 1:2.15 |
| 2. | PBW-175 | 25 qt/ha | 25.5 | 25.25 | 24800 | 1:3.15 |
| 3. | PBW-527 | 23 qt/ha | 22.5 | 22.75 | 22600 | 1:2.85 |
| 4. | PBW-621 | 18 qt/ha | 17.8 | 17.90 | 14800 | 1:2.50 |
| 5. | HS-490 | 27 qt/ha | 27.5 | 27.25 | 26900 | 1:3.35 |

Table 2. Performance of wheat varieties in Reasi district at farmers field during 2013-14 and 2014-15

| Districts | Locations | No. of Fields | Disease severity (%) Year 2013-14 | 2014-15 | 2015-16 |
|-----------|-----------|---------------|-----------------------------------|-----------|-----------|
| Reasi, | 10 | 50 | 11.8 | 12.5 | 14.2 |
| Udhampur | 10 | 50 | 10.5 | 11.2 | 12.8 |
| Rajouri | 10 | 50 | 11.2 | 12.8 | 13.5 |
| Mean | - | - | 11.16 | 12.16 | 13.5 |
| Range | - | - | 10.5-11.8 | 11.2-12.8 | 12.8-14.2 |

In most wheat producing areas yield losses caused by stripe rust have ranged from 10 to 70 per cent, depending on the susceptibility of cultivar, earliness of the initial infection, rate of disease development and duration of disease (Chen, 2005, Ahamad, 2016). The distribution of the disease depends much upon climatic factors such as rainfall, humidity, temperature, etc. (Emge and Johnson, 1972). Lower temperature of 6 to 18°C, wet conditions along with intermittent rains favors stripe rust epidemics (Cortazar,1985). In India, yellow rust was observed in Punjab, Haryana, Western Uttar Pradesh and Jammu and Kashmir and was adjudged to be responsible for considerable yield losses (Nagarajan *et al.*, 1984).

During cropping season of 2010-11, the stripe rust appeared in severe form in almost all the wheat growing areas of Jammu region of Jammu and Kashmir state of India, wherein, wheat was grown over an area of 239 thousand hectares with a production and productivity of 465.33 thousand tones and 19.47q ha⁻¹, respectively (Anonymous, 2011, Ahamad,2016). Further, variation in climatic conditions had led to a breakdown of disease resistance in mega wheat variety PBW-343 as well as out-breaks of new pathotypes, which caused a significant loss to the production of wheat. Timely application of newly identified fungicide molecules restricted the spread of stripe rust (Chen,2005) but its use was found to be uneconomical and ecologically unsafe. As most of wheat varieties growing in Jammu regions has become susceptible to yellow rust disease, there is a need to know the present status of disease in Reasi, Udhampur and Rajouri districts of Jammu region, source of resistance and performance of present wheat varieties against the *P. striiformis*.

MATERIALS AND METHODS

Occurrence of the stripe rust of wheat

The wheat growing areas of Jammu region i.e. Reasi, Udhampur and Rajouri were surveyed to ascertain the distribution of stripe rust, during *Rabi* seasons of 2013-2014, 2014-2015 and 2015-2016. Disease incidence and disease severity infected were recorded at 15 days interval from February onwards till harvesting of the crop by simple random sampling using Modified Cobb's Scale (Peterson *et al.*, 1948)

RESULTS AND DISCUSSION

The data presented in Table 1 revealed that the stripe rust of wheat was found- prevalent in the intermediate zone of all the major wheat growing areas of Jammu region in all the three cropping seasons of 2013-2014 to 2015-2016. During 2015-2016, Reasi district recorded the maximum disease severity i.e 14.2%. Disease severity was found maximum during 2015-2016 in the range of 12.8 to 14.2 due to higher temperature. The minimum disease severity was found in the 2013-2014 in the range of 10.5 to 11.8 due to perhaps low temperature was found in the region. Low yield of wheat crop was due to lack of availability of high yielding varieties of wheat in the district infestation of stripe rust disease in the region. Hailuar and Fininsab (2006) have also reported that stripe rust epidemics vary significantly between locations, seasons and also among cultivars. Gupta *et al.* (2005) stated that the cultivation of susceptible varieties on large scale in the irrigated areas of sub-tropics along with intermittent rains during February, and March played a major role in the build-up of inoculums for development of the stripe rust. Although the replacement of susceptible varieties was through on mass scale but the presence of inoculums increased the disease severity and incidence in the successive year, whereas in the intermediate region, the maximum area under cultivation of wheat was rainfed and the average rainfall (84.30 mm) was also high and was in consonance with the critical water requirement stages of the crop, but due to low relative humidity, the rate of disease development was slow and the hosts showed tolerance response against the disease.

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