



Sources of Seedling and Adult Plant Resistance to Leaf Rust in Spring Wheat Germplasm

Sabina Asghar, Faqir Muhammad, Aziz Ur Rehman, Makky Javed, Sadia Ajmal, Aneela Ahsan, Saima Gulnaz and Javed Ahmad

Wheat Research Institute, Ayub Agricultural Research Institute, Faisalabad, Pakistan

*Email: sabina_mlk@hotmail.com



INTRODUCTION

Leaf rust caused by *puccinia triticina* is a serious threat and results in major yield losses to wheat production in warm areas like Pakistan (Hassan 1979, Huesta-Espino *et al.* 2011). Wheat breeders mostly introduced wheat breeding material depending upon varieties containing genes Lr 1, Lr 13 and Lr 26 in combination with the minor genes (Rehman *et al.* 2013). The cultivars developed with monogenic or vertical resistance could not live long therefore now, the breeders are mainly depending on new sources of resistance to leaf rust based on minor genes which slows down the rust development and significantly reduce the losses due to rusts (Niks and Rubiales 2002). Area Under Disease Progressive Curve (AUDPC) has been used by many scientists to understand disease development pattern and they preferred the genotypes having slow rusting pattern with lower AUDPC values for rust (Pawan *et al.* 2015). The current studies were designed to screen wheat germplasm for identification of leaf rust resistance sources and to sort out slow rusting genotypes for use in the breeding program.

MATERIALS AND METHODS:

Two hundred and fifty genotypes/advanced lines and ninety one genes/gene differentials were sown in November during the years 2016-17 and 2017-18 at four different agro-ecological locations of Punjab viz. Faisalabad, Khanewal, Bahawalpur and Kot Naina. Each entry was sown in a 2 meter long single row by maintaining 30cm row to row distance. A single line of susceptible cultivar, Morocco was repeatedly sown after every ten lines of experimental material. At Faisalabad, the inoculation of material was done three times during first fortnight of February at an interval of five days. The previous years collected inoculums mixture (mixture of pathotypes found from all over Punjab) was used for inoculation and dusted on experimental material. The leaf rust data was recorded three times on these dates i.e. 02-03-2018, 15-03-2018 and 29-03-2018. The data was used to calculate Area Under Disease Progressive Curve (AUDPC) by following Pandey *et al.*, 1989 and Singh *et al.*, 2000.

$$AUDPC = \sum_{i=1} \{[(Y_i + Y_{(i+1)}) / 2] \times (t_{(i+1)} - t_i)\}$$

At all other three locations, disease appearance was based on natural inoculation. The data was recorded following Modified Cobb's Scale and the entries were classified as resistant, moderately resistant, moderately susceptible, moderately resistant to moderately susceptible and susceptible described by Peterson *et al.* (1948).

Results and Discussion

From the two year data at four locations, it was concluded that V HYT 60-5 was the advanced line which did not show any disease symptoms at all the four locations of the Punjab, Pakistan, Therefore, this can be treated as the most promising leaf rust resistant genotype for use in the breeding program. Similarly, the gene differentials containing Lr-19, Lr-26 and Lr-27+31 did not show any susceptibility at any target location during the two study years. Therefore, the material containing these three genes may be targeted for improving leaf rust resistance in bread wheat breeding material.

AUDPC ranged from 0-550 while that of Morocco which is a susceptible check has AUDPC value of 600. One hundred and twenty entries have disease progression 0 which shows there may be a major gene based resistance in these entries. AUDPC/DAY was calculated for the rest of one hundred and thirty entries, out of which forty three entries have AUDPC/Day value ranging from 1-2 and twenty eight entries have AUDPC/Day value ranging from 2-3 which shows that these entries are extremely useful for use in breeding for durable rust resistance and can be utilized as a parent in back cross and top cross in breeding scheme.

CONCLUSION AND FUTURE PROSPECT:

The material screened at different locations all over the Punjab showed that different breeding lines and gene differentials behaved differently with change in environmental conditions due to genotype environment interaction. As the inoculum used was a mixture of races collected from different locations of Punjab during the previous three years. Leaf rust genes Lr-19, Lr-26 and Lr-31 showed resistance against the prevalent inoculum in different agro-ecological zones of the Punjab. Hence, these genes can be explore in breeding programs for leaf rust resistance. Among the tested advanced lines, V-14154, V-14124 and HYT 60-5 were very useful for release as a commercial variety or use as a parent for leaf rust resistance as they showed resistance against leaf rust all over Punjab. Among the current commercial varieties of the Punjab, Ujala-16 has shown the best resistance for leaf rust.

REFERENCES:

- 1- Figlan, S, K. Ntushelo. L. Mwardzingeri, T. Terefe, T.J. Tsilo and H. Shimeles. 2020. Wheat breeding for durable rust resistance in Southern Africa: variability, distribution, current control, strategies, challenges and future prospects. *Front. Pl. Sci.* <http://doi.org/10.3389/fpls.2020.00549>.
- 2- Wu, H, Z. Kang, Y. Li, Y. Li, .Wang and D. Liu. 2020. Identification of wheat leaf rust resistance genes in Chinese wheat cultivars and improved germplasm. *Plant diseases.* <http://doi.org/10.1094/pois-12-19-2619-RE>.