

# Adult plant resistance to leaf and stripe rust in landraces

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CIMMYT works continuously with national program partners to find resistance to rust pathogens and introduce it into well-adapted and high-yielding wheat varieties. In the present study we tested a number of landraces against prevalent leaf and stripe rust races in Pakistan to identify resistance genes and to incorporate those into adapted bread wheat cultivars.

## Materials and methods

63 Pakistani landraces from the Plant Genetic Resources Institute at NARC-Islamabad were tested in field conditions at two locations for resistance to leaf and stripe rust during the 2012-13 wheat growing season. Stripe rust resistance was assessed at the national partner's Cereal Crop Research Institute (CCRI)-Pirsabak in non-replicated 1 m single-row trials; leaf rust resistance was tested at the Wheat Research Institute (WRI), Faisalabad, Punjab, in non-replicated 2 m single-row trials. The landraces were inoculated with the prevalent races of each pathogen. Rust scoring recorded (1) severity; that is, the percentage of tissue rusted, on a Modified Cobb Scale from 0 to 100% and (2) host reaction (HR), measured as 0, R, MR, MR-MS, MS and S, based on the symptoms given in Table 1. The severity in percentage was multiplied with a constant value for each type of HR (Table 1) to get a coefficient of infection (CI); (Safavi and Farzad 2012; Afzal et al. 2009).

**Coefficient of infection = percent severity × constant of HR**

**Table 1. Field response of host plant to wheat rusts used during disease scoring.**

Reaction	Description	Observation	Response value
No disease	No visible infection	0	0
Resistant	Visible chlorosis or necrosis, no uredia are present	R	0.2
Moderately resistant	Small uredia surrounded by chlorotic/necrotic areas	MR	0.4
Mod. res-mod. Susceptible	-	MR-MS	0.6
Moderately susceptible	Uredia medium size with no necrotic margins, possibly some distinct chlorosis	MS	0.8
Susceptible	Large uredia with no necrosis and little or no chlorosis	S	1.0

Response value: Constant values of infection types (Pathan and Park 2006).

**Table 2. Resistant level of the tested wheat landrace accessions based on Coefficient of Infection.**

CI range	0-20	21-40	41-60
Resistance level	High	Moderate	Low
<i>Stripe rust, CCRI Pirsabak KPK</i>			
Entries (%)	81	12	6
<i>Leaf rust, WRI Faisalabad Punjab</i>			
Entries (%)	74	19	6

## Results and discussions

Landraces with CI values of 0-20, 21-40, and 41-60 were considered as having high, moderate, and low levels of adult plant resistance (APR), respectively. For leaf rust, most (47) landraces had CI values up to 20 and thus high levels of APR. Landraces 10763, 10781, 10986, 10990, 10997, 11000, 11001, 11015, 11025, 11397, 11415, and 11431 showed CI values up to 40 and were scored as moderately resistant. Only four landraces, 11190, 11200, 11405 and 11427, showed CI >40 and were considered to possess low levels of (or no) APR.

Of the 63 landraces screened at CCRI-Pirsabak, 51 were resistant (CI 0-20) and only four (11029, 11382, 11396 and 11422) were susceptible to stripe rust, with CI >40. The remaining 8 landraces had CI values of 21-40 and thus moderate levels of APR.

Combining the data from both locations, 39 landraces showed resistance to both leaf and stripe rust. Four (10990, 11000, 11015 and 11025) showed moderate APR to both rusts. The landraces 10985, 10987, 11007, 11029, 11382, 11396, 11422 and 12967 showed higher APR to leaf but not to stripe rust. Similarly, 12 landraces were resistant to stripe but not to leaf rust disease. Further characterization of these landraces will provide more insight into the nature of the resistances and whether they are new or already available in the wheat cultivar gene pool.



**Figure 1. Wheat leaf and stripe rust field reactions at the test locations.**

## References

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