SHORT COMMUNICATION

Diversity for resistance to stem and leaf rusts in durum wheat (Triticum turgidum ssp. durum)

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India produces >90 million tonnes of wheat from an area of >25 million ha. Of the wheat production, durum wheat (Triticum turgidum ssp. durum) contributed about 5%. However, durum wheat has a special niche in Indian wheat economy for at least two reasons. Indian durum wheat is typically purchased by private trade at a price premium, mainly for processing of high-value products. In addition, durum wheat is preferred over bread wheat for several local food preparations. It is mainly grown in central and peninsular parts of India, where stem and leaf rusts are major disease problems. Cultivation of resistant varieties is most effective, economic and eco-friendly method of disease management. Broadening of resistance base through utilization of diverse resistance sources is necessary for enhancing the durability of rust resistance in view of the continued evolution of rust pathogens.

A total of 1105 durum wheat germplasm accessions including released varieties, advanced generation lines, land races and indigenous as well as exotic genetic stocks were evaluated for field resistance at IARI-RS, Indore, to stem and leaf rusts during rabi 2002-03 under heavy inoculum pressure, using mixtures of important pathotypes of both rusts. In all, 107 genotypes showing adequate levels of field resistance (terminal rust severity up to 10S) to both the rusts were selected and are being tested since then year-after-year for ascertaining the stability of resistance. They have been observed maintaining their field resistance to both stem and leaf rusts till date (authors' unpublished observations). Hence, present study was carried out during 2010-2012 to explore the extent of diversity for rust resistance among these genotypes through multi-pathotype seedling tests.

The selected 107 durum wheat genotypes were seedling tested with five stem rust pathotypes, viz. 117-1 (166G2), 117-3 (167G3), 117-6 (37G19), 117A (38G2), and 117A-1 (38G18); and eight leaf rust pathotypes, viz. 11 (0R8), 12-2 (1R5), 12-5 (29R45), 104-2 (21R55), 104-3 (21R63), 106 (0R9), 162-2 (93R39) and 162-3 (29R7). These pathotypes were chosen because they showed high degrees of virulence to durum wheat germplasm among 24 stem rust and 40 leaf rust pathotypes tested (5).

The seedling tests were conducted at 20-22°C ± 2°C using standard glasshouse procedures (7). The test seedlings were raised in 10 cm clay pots. Seedlings with primary leaf fully expanded and second leaf just emerged (generally 8-10 days old) were spray inoculated with aqueous suspension of uredospores of individual test pathotypes, freshly collected from actively sporulating pots of ‘Agra Local’ maintained in isolation in glasshouse. Agra Local served as ‘susceptible check’. Inoculated pots were incubated in moist chambers for 16-24 h, and were then transferred to glasshouse benches. Infection types (ITs) on seedlings were recorded 12-15 days after inoculation on a 0-4 scale. The Infection Types (ITs) 3, 3+, 34 and 4 produced by a pathotype on a host line indicated latter’s susceptibility to that pathotype, whereas lower ITs (’0’, ’1’, ’2’ and ’X’) indicated resistance (7).

A good measure of diversity for rust resistance was observed, as the genotypes studied could be classified in to 8 (eight) diverse groups for stem rust resistance, and 12 diverse groups for leaf rust resistance, based on their seedling responses to the test pathotypes, as listed below:

Diverse groups for stem rust resistance

**Group I.** Resistant to all the test pathotypes (number of genotypes = 55)


**Group II.** Resistant to all the test pathotypes except 117-6 (number of genotypes = 12)


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**Group III.** Resistant to all the test pathotypes except 117-1 (number of genotypes = 8)
CPAN 6038, CPAN 6040, ED 2398-A, Guji 'S', HI 8634, ID (99)-67, MPO 3-24, and RD 773.

**Group IV.** Resistant to all the pathotypes except 117-1 and / or 117-3 (number of genotypes = 5)
CIMB 1632, CIMB 1633, CIMB 1649, CIMB 1655, and P 6046.

**Group V.** Resistant to all the pathotypes except 117-6 and 117-1 / 117A (number of genotypes = 4)
HG 622, IWP 5013, IWP 5019, and VD 2001-14.

**Group VI.** Resistant only to the pathotypes 117-1 and 117-3 / 117A-1 (number of genotypes = 2)
CIMB 1645, I 7805.

**Group VII.** Susceptible to all the test pathotypes (number of genotypes = 11)
CPAN 6137, CPAN 6139, D 104, E 4303, HI 8591, I 1568, ID 1128, ID 1169, JD 01-12, JD 01-14, and MPO 3-20.

**Diverse groups for leaf rust resistance**

**Group I.** Resistant to all the test pathotypes (number of genotypes = 42)

**Group II.** Resistant to all the test pathotypes except 12-2 (number of genotypes = 26)

**Group III.** Resistant to all the test pathotypes except 11 and / or 104-2 (number of genotypes = 3)
CIMB 1655, I 1568, I 15173.

**Group IV.** Resistant to all the test pathotypes except 11 and 12-5 / 106 (number of genotypes = 6)

**Group V.** Resistant to all the test pathotypes except 104-2 and 12-2 / 12-5 (number of genotypes = 4)
CIMB 1564, DD(99)-55, HI 8627, and MPO 3-21.

**Group VI.** Resistant to all except two or more among 11, 12-5, 162-2 and 162-3 (number of genotypes = 5)
CPAN 6137, D 104, HG 402, HI 8634, and MPO 3-23.

**Group VII.** Resistant to all except 12-5, 104-2, and 12-2 / 162-2 (number of genotypes = 6)
B 414, B 662, CPAN 6038, CPAN 6040, HI 8591, and MPO 3-19.

**Group VIII.** Resistant only to pathotypes 11, 104-3, 106, and 12-2 / 104-2 (number of genotypes = 2)
CIMB 1645, CPAN 6139.

**Group IX.** Resistant only to the pathotypes 11, 104-3, and 106 (number of genotypes = 2)
CIMB 1632, and GW 1139.

**Group X.** Resistant only to the pathotypes 11, 12-5, and 162-3 (number of genotypes = 1)
HG 110

**Group XI.** Resistant only to the pathotypes 11, 104-3, and / or 162-3 (number of genotypes = 3)

**Group XII.** Resistant to the pathotype 104-3 only (number of genotypes = 7)
CIMB 1583, DR 154, ID 1128, ID 1169, JD 01-32, Line 1172, and WH 804.

Analysis of data revealed that 25 genotypes, viz. AKDW 3347, CPAN 6236, GW 1182, HG 320, HG 764, HG 1312, HI 8592, ID (99)-66, ID (99)-67, ID (99)-68, ID (99)-69, ID (99)-72, ID (99)-73, ID (99)-75, ID (99)-77, IWP 5019, JD 01-12, JD 01-37, MACS 2067, MACS 3493, MPO 3-24, MPO 622, Raj 6069, Raj 6562, RD 773, RD 895, RKD 97, WD 2001-30, WD 2001-37, and Yuk showed resistance to all the test pathotypes of stem and leaf rusts, and hence, can serve as donors for combined resistance to both the rusts. However, 11 genotypes which showed seedling susceptibility to all the stem rust pathotypes (Group VIII) are of particular interest from the viewpoint that most examples of durable rust resistance are of adult-plant type. These genotypes need to be studied further for characterizing the resistance genes present in them. Only two genes for adult-plant resistance to stem rust, viz. recessively inherited Sr2 derived from *Triticum turgidum* var. dicoccum cv. Yaroslav Emmer (3), and undesignated dominant gene present in durum cultivar 'Glossy Hugenot' (1) are known to be of tetraploid (AABB genomes) background origin (4).

Relatively few studies have been conducted on the diversity for rust resistance in durum wheat germplasm based on multi-pathotype tests. On the basis of patterns of seedling reactions to 24 stem rust pathotypes and 40
leaf rust pathotypes, at least 18 diverse groups for stem rust resistance among 71 durum genotypes, and nine for leaf rust resistance among 50 durums could be identified (6). On the basis of evaluation with leaf rust race 77 in glasshouse and under field conditions, 362 durum wheat accessions were classified into three groups (2). Out of 50 durum wheat accessions seedling tested with 5-10 leaf rust cultures, 23 unique reaction patterns were observed among 43 accessions (9). In an earlier study, 36 durum genetic stocks could be classified in to nine diverse groups depending upon similarity of the overall reaction to eight leaf rust cultures (8). However, present study had a more focused approach, as seedling responses to specifically durum virulent stem and leaf rust pathotypes formed the basis of assessing diversity for resistance in durum genotypes with proven field resistance. Hence, information presented here would be useful in providing guidelines for utilizing diverse resistance sources toward broadening of rust resistance base in durum improvement programmes.

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REFERENCES


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