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Rusting behaviour of some wheat cultivars against leaf rust under artificial epiphytotic conditions

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India is the second largest wheat producer in world, next to China. By 2020 AD targeted wheat production is 109 M tons (7). To achieve this target various technologies need to be exploited. In wheat production main threat is interference of biotic stresses and chief among them is leaf rust *Puccinia recondita* f.sp. *triticina*. Host Plant Resistance is eco-friendly management approach, for which both vertical and horizontal resistance have been recognized. The cultivation of improved resistant cultivars boosted wheat yields. However, monoculturing sometimes led to epidemic of leaf rust (3).

Slow rusting is a relative term to explain behaviour in cereals, where the resistance is characterized by slow rate of rust development. The phenomenon is marked by low disease severity. The *Lr* 34 gene is recognized as an adult plant resistance (APR) gene due to its non-hypersensitive reaction as well as slow disease progress (6).

The durability of leaf rust resistance with *Lr* 34 occurs in combination with other genes. In the present study 10 genotypes with known gene combination (1,2) were evaluated under artificial epiphytotic conditions at Mahabaleshwar.

The experiment was conducted with genotypes, HD 2501, GW 173, HD 2189, PBW 396, C 306, VL 738, HS 240, SONALIKA, PBW 175 and HUW 234 for three successive *Rabi* seasons during 1999 to 2002.

The crop was raised following recommended agronomic practices. The inoculum suspension made from mixture of urediospores of predominant leaf rust pathotypes, 1R5 (12-2), 69R13 (12-4), 45R31 (77), 109R31 (77A), 109R63 (77-1), 109R31-1 (77-2), 121R63-1 (77-5), 21R55 (104-2), 21R63 (104-3), 13R57 (108), 57R27 (108-1), 93R7 (162), 93R15 (162A) was repeatedly sprayed on the test material from seedling stage to flag leaf stage. Universally susceptible varieties, Agra local, Pusa 4, Gulab, Lal Bahadur, A-9-30-1, were sown as infector rows.

Sufficient care was taken for establishment of infection and build of leaf rust (4). The observations on leaf rust progress were recorded by noting the percent rust severity (5) on flag and flag-1. Average Coefficient of Infection (ACI) was calculated by multiplying with assigned value to each of infection type and percent severity of leaf rust (4). The ACI for each variety was computed for total observations during each year. The values of Area Under Disease Progress Curve (AUDPC) were calculated by using the formula (8).

$$A = \sum_{i=1}^{k} \tfrac{1}{2}(Si + Si\ 1)d$$

where A is AUDPC, Si is disease severity at the end of week i, K is number of successive evaluations of rusts and d is interval in days between observations. The percent relative AUDPC values were also calculated using the following formula.

$$\% \text{ relative AUDPC} = \frac{\text{AUDPC value of the genotype}}{\text{AUDPC value of Sonalika}} \times 100$$

The genotype Sonalika was considered as control to compare with other genotypes. The different leaf rust resistance genes identified earlier (1,2) in test varieties have been given in Table 2.

Table 1. Terminal leaf rust severity of wheat varieties during 2000,2001 and 2002

Variety	Response of variety	Terminal Severity			Mean ACI
		1999-2000	2000-2001	2001-2002	
HD 2501	MS	5	8	1.6	4.8
GW-173	MS	5	16	2.0	7.6
HD-2189	MS	15	10	8.0	11.0
PBW-396	MS	5	8.0	8.0	7.0
C 306	S	2	10	50	20.6
VL-738	S	16	20	50	28.6
HS-240	S	16	50	50	38.6
PBW-175	S	80	60	32	57.3
HUW-234	S	80	80	40	66.6
Sonalika	S	80	60	80	73.3

Table 2. Relative values of Area under Leaf Rust Progress Curve of Wheat Varieties during 2000,2001, and 2002

Variety	Lr genes	Relative values of AULRPC			Mean
		1999-2000	2000-01	2001-02	
H 2501	*Lr* 23,34	02.4 +	03.1	01.7	02.4
		(14.0) *	(30.0)	(16.8)	(20.2)
GW 173	*Lr* 23,34	08.7	10.5	05.5	08.8
		(49.1)	(100.0)	(54.0)	(67.7)
HD-2189	*Lr* 1,3,13,34	05.9	07.9	11.7	08.9
		(33.4)	(75.0)	(114.0)	(74.1)
PBW-396	*Lr* 26	08.2	14.7	08.1	10.6
		(46.6)	(140.0)	(79.2)	(88.6)
C-306	*Lr* 34	07.5	18.4	10.5	12.8
		(42.5)	(175.0)	(102.2)	(106.5)
VL 738	*Lr* 26,23,34	18.5	23.6	83.5	45.9
		(104.7)	(225.0)	(812.5)	(380.7)
HS 240	*Lr* 26,1,34	38.5	50.0	47.5	46.4
		(217.4)	(475.0)	(462.0)	(384.8)
PBW 175	*Lr* 23,34	66.6	86.8	27.2	58.9
		(375.8)	(825.0)	(265.2)	(488.6)
HUW 234	*Lr* 14 a	113.2	26.3	74.7	65.0
		(639.2)	(250.0)	(727.0)	(538.7)
Sonalika	*Lr* 13,14a	100.0	100.0	100.0	100.0
		(564.2)	(950.0)	(972.0)	(828.7)

+ Values are in percent relative to Sonalika

* Values in parentheses are original AUDPC values

Three years analysis during 1999-2000, 2000-2001, and 2001-2002 shows that, test genotypes produced 'MS' to 'S' type of pustules, confirming the non-hypersensitive resistance. The ACI varied from 4.8 to 66.6 on HD 2501 and HUW 234, respectively. The terminal ACI of genotypes showed wide variation during the three-year period. The HUW 234 and PBW 175 showed highest terminal ACI between 32 and 80 during three crops seasons. While, the genotypes, HD 2501, GW 173, PBW 396 and HD 2189 showed low mean terminal ACI ranging between 4.8 and 11.0. The genotypes HD

2501, GW 173 and HD 2189 revealed low AUDPC values i.e. 2.4, 8.8 and 8.9, respectively which also carry *Lr* 34. Rubiales and Nike (6) characterized *Lr* 34 as a major gene, conferring non-hypersensitive resistance to leaf rust. The genotype C 306 has *Lr* 34 and an unidentified gene in addition,. It is interesting to note that the relative AUDPC values of PBW 396 is 10.6, which dose not carry *Lr* 34. The AUDPC value in HD 2189 and C 306 were 8.9 and 12.8 indicating that, an unknown/ unspecified *Lr* gene is playing a role in reducing the AUDPC value which needs further investigation. The genotype VL 738, HS 240 and PBW 175 possessing *Lr* 34 showed higher AUDPC values. Two genotypes HD 2501 and PBW 175 possessing Lr 23 + Lr 34 revealed AUDPC values between 20.2 and 58.9.

Cultivars HD 2501, GW 173 and HD 2189 with least terminal ACI and relative AUDPC values are identified as genotypes with considerable amount of adult plant resistance against leaf rust and cultivar C 306 identified as slow leaf rust resistance genotype and could be utilized in the wheat improvement programme.

REFERENCES

1. **Anonymous** (2001). *Annual Report*. Regional Station, DWR, Flowerdale, Shimla : pp. 48-51.
2. **Bahadur, P.** (1997). Adult plant resistance in 37 Indian wheat. "International conference on Integrated plant disease management for sustainable agriculture.: *In Golden Jubilee Celebration of IPS* held at New Delhi from November 11-15 , 1997. pp. 644-649.
3. **Joshi, L.M., Srivatav, K.D. , Singh, C.V.** and **Ramanujan, K.** (1980). *Cereal Rust Bull* **8**: 17-21.
4. **Joshi, L. M., Singh, C.V.** and **Srivatav, K.D.** (1988). *Manual of Wheat Diseases*. Malhotra Publishing House, New Delhi, pp. 75.
5. **Peterson, R.E., Campbell, A.B.** and **Hannah, A.E.** (1948). *Can. J. Res*. **26**: 496-500.
6. **Rubials, D.** and **Nikes, R.E.** (1995). *Pl. Dis*. **79**: 1208-1212.
7. **Singh, G.S., Singh, G.P.** and **Sharma, J.B.** (2002). Abct. *in II nd international Group meeting on Wheat technologies for warmer areas* : pp. 10-11.
8. **Wilcoxson, R.D., Skovmand, B.** and **Atif, A.A.** (1975). *Ann. appl. Biol*. **80**: 275-281.

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